

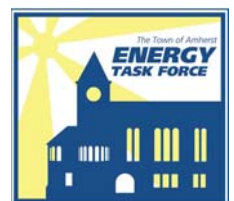


The Town of Amherst Massachusetts

CLIMATE ACTION PLAN

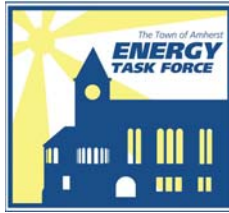


Prepared by the Town of Amherst
Energy Conservation Task Force
October 2005



ACKNOWLEDGEMENTS

The Climate Action Plan was prepared by
the Town of Amherst Energy Conservation Task Force.



The Town of Amherst Energy Conservation Task Force consists of the following members:

Larry Archey	Hampshire College
Jason Burbank	UMASS Amherst
Stephanie Ciccarello	Town of Amherst
Tina Clarke	Amherst Resident
Barry Del Castilho	Town of Amherst
Aaron Hayden	Amherst College
Julie Johnson	Hitchcock Center for the Environment
Karen Jones	Amherst Public Transportation Committee
Niels LaCour	Town of Amherst
Steve Roof	Hampshire College
Rob Snyder	Amherst Resident
Amy Verel	Graduate Intern, UMASS Amherst

Special thanks to the following individuals who have contributed to the development of the Climate Action Plan:

David Ahlfeld	Amherst Resident
Anne Awad	Amherst Select Board
Bart Bales	SolarWorks
Glenn Barrington	UMASS Transit
John Coull	Amherst Chamber of Commerce
Marc Fournier	UMASS Amherst
Hwei-Ling Greeney	UMASS Sustainable Operations
Carolyn Holstein	Town of Amherst
Marianne Jakus	Amherst Public Transportation Committee
Van Kaynor	Amherst Public Transportation Committee
Ann Kearns	Amherst Resident
Ned Markert	Town of Amherst
Martha Nelson	UMASS Amherst
Ludmila Pavlova	UMASS Amherst
John Pepi	UMASS Amherst
Lindsay Stromgren	Town of Amherst
Peter Westover	Town of Amherst

TABLE OF CONTENTS

EXECUTIVE SUMMARY - 6 -

I. INTRODUCTION - 8 -

THE SCIENCE OF GLOBAL CLIMATE CHANGE	- 8 -
THE KYOTO PROTOCOL	- 10 -
GLOBAL CLIMATE CHANGE AND ITS IMPACTS ON MASSACHUSETTS	- 10 -
CITIES FOR CLIMATE PROTECTION	- 11 -
& THE AMHERST ENERGY CONSERVATION TASK FORCE	- 11 -
AMHERST'S GREENHOUSE GAS EMISSIONS INVENTORY AND FORECAST	- 12 -
CLEAN AIR AND CLIMATE PROTECTION SOFTWARE	- 13 -

II. THE CLIMATE ACTION PLAN: VISION, STRATEGIES & GOALS - 15 -

A. ENERGY USE AND FACILITIES	- 16 -
THE ROLE OF ENERGY USE AND FACILITIES IN AMHERST'S GHG EMISSIONS	- 16 -
THE REGIONAL GREENHOUSE GAS INITIATIVE	- 17 -
TOWN ENERGY USE & FACILITIES STRATEGIES	- 18 -
INSTITUTIONAL ENERGY USE & FACILITIES STRATEGIES	- 20 -
B. TRANSPORTATION	- 25 -
THE ROLE OF TRANSPORTATION IN AMHERST'S GHG EMISSIONS	- 25 -
AMHERST'S PUBLIC TRANSPORTATION COMMITTEE	- 26 -
AMHERST'S PUBLIC TRANSPORTATION SYSTEM	- 27 -
TOWN TRANSPORTATION STRATEGIES	- 27 -
INSTITUTIONAL TRANSPORTATION STRATEGIES	- 31 -
OTHER TRANSPORTATION STRATEGIES	- 34 -
C. WASTE MANAGEMENT	- 36 -
THE ROLE OF WASTE IN AMHERST'S GHG EMISSIONS	- 36 -
AMHERST'S SOLID WASTE COMMITTEE	- 36 -
TOWN WASTE MANAGEMENT STRATEGIES	- 36 -
INSTITUTIONAL WASTE MANAGEMENT STRATEGIES	- 38 -
OTHER WASTE MANAGEMENT STRATEGIES	- 41 -
D. LAND USE AND PLANNING	- 42 -
THE ROLE OF LAND USE AND PLANNING IN AMHERST'S GHG EMISSIONS	- 42 -
GETTING IT ALL TOGETHER IN A MASTER PLAN	- 42 -
TOWN LAND USE AND PLANNING STRATEGIES	- 43 -
INSTITUTIONAL LAND USE AND PLANNING STRATEGIES	- 48 -

III. COMMUNITY EDUCATION AND RESOURCES - 49 -

TOWN EDUCATION STRATEGIES	- 49 -
---------------------------	--------

<u>IV. IMPLEMENTATION AND MONITORING</u>	<u>- 54 -</u>
---	----------------------

<u>V. CONCLUSION</u>	<u>- 56 -</u>
-----------------------------	----------------------

<u>APPENDIX A: CITIES FOR CLIMATE PROTECTION CAMPAIGN (CCP)</u>	<u>- 57 -</u>
--	----------------------

<u>APPENDIX B: TOWN OF AMHERST, MA RESOLUTION FOR PARTICIPATION IN THE CITIES FOR CLIMATE PROTECTION (CCP) CAMPAIGN, APRIL 2000</u>	<u>- 58 -</u>
--	----------------------

<u>APPENDIX C: TOWN OF AMHERST, MA RESOLUTION FOR PARTICIPATION IN THE AMHERST RENEWABLE ENERGY CAMPAIGN, AUGUST 2005</u>	<u>- 59 -</u>
--	----------------------

<u>APPENDIX D: AMHERST CRITERIA AIR POLLUTANTS REDUCTIONS IN 2009</u>	<u>- 60 -</u>
--	----------------------

<u>APPENDIX E: TOWN OF AMHERST GREENHOUSE GAS EMISSIONS INVENTORY</u>	<u>- 61 -</u>
--	----------------------

COMMON ABBREVIATIONS & ACRONYMS IN THIS DOCUMENT

AFV	Alternative Fuel Vehicle
CCP	Cities for Climate Protection Campaign
eCO ₂	Equivalent Carbon Dioxide
°F	Degrees Fahrenheit
GHG	Greenhouse Gas
Hi-E	High Efficiency Motor
ICLEI	ICLEI-Local Governments for Sustainability
kWh	Kilowatt hour
CH ₄	Methane
Mpg	Miles per gallon
mmbtu	Million Btu
NO _x	Nitrogen oxides
PVPC	Pioneer Valley Planning Commission
PVTA	Pioneer Valley Transit Authority
TMA	Transportation Management Association
ULEV	Ultra-Low Emissions Vehicle
VFD	Variable Frequency Device
VMT	Vehicle Miles Traveled
ZEV	Zero Emissions Vehicle

EXECUTIVE SUMMARY

"If we can get enough local communities around the world working on global environmental problems, we can have a global impact," says Abby Young, director of the CCP Campaign. "It is the day-to-day activities - driving cars to and from work, running fridges, and heating homes and offices that contribute to global warming."

The Town of Amherst has joined in a worldwide effort by committing its government, businesses and citizens to implement programs to reduce the emissions of greenhouse gases. In April of 2000, the Town's Select Board signed a resolution to participate in the Cities for Climate Protection (CCP) Campaign. In doing so, Amherst has joined with 21 local governments in Massachusetts, 150 across the country, and 626 worldwide in the CCP Campaign administered through ICLEI – Local Governments for Sustainability, an international association of local governments and national and regional local government organizations that have made a commitment to sustainable development.

As a participant in the CCP Campaign, the Town convened an Energy Conservation Task Force to complete a 'Five Milestone' Process:

- 1. Complete a Greenhouse Gas Emissions Inventory and Report**
- 2. Set an Emissions Reduction Target**
- 3. Complete a Local Climate Action Plan to Reduce Greenhouse Gas Emissions**
- 4. Implement the Local Climate Action Plan**
- 5. Monitor the Impact of Emissions Reductions Measures**

The first milestone, a Greenhouse Gas Emissions Inventory, was completed in the summer of 2001 using specialized software provided by ICLEI. The completed inventory set a 1997 baseline measurement of equivalent carbon dioxide emissions (eCO₂) in Amherst. The 1997 baseline measurement took into consideration all sectors of Amherst – municipal, residential, commercial, industrial, and institutional. The Inventory indicated that approximately 320,960 tons of eCO₂ were released from sources in Amherst in 1997. Using this baseline, an emissions forecast indicates that 318,940 tons of eCO₂ will be released in 2009 if no actions are taken to address GHGs in the Town. The reason for this net reduction (2,020 tons) is the 2003 closing of the Amherst landfill, a significant contributor to Amherst's 1997 GHG emissions. Otherwise, GHG emissions for all sectors in Amherst (residential, commercial, industrial, transportation, and waste) are forecasted to increase significantly by 2009¹.

The CCP Campaign has determined that it is imperative to reduce greenhouse gas emissions to actively address global climate change. Therefore, the second milestone in the process involved setting a greenhouse gas emissions reduction target. The Town has set the goal of reducing emissions in 2009 to 35 percent below 1997 levels. In order to reach this target, 139,201 tons of eCO₂ have to be eliminated between 1997 and 2009. Because the Emissions Inventory and this Plan use 1997 as a baseline year, emissions reductions measures undertaken since 1997 are included in the Plan. These measures already in place account for 43,532 tons of eCO₂ saved between 1997 and 2005, leaving a remaining 95,660 tons of eCO₂ to be eliminated between 2005 and 2009. This is a reasonable and achievable goal, in part because many measures, particularly energy-saving facilities improvements undertaken by the Town, UMASS Amherst, and Amherst and Hampshire Colleges, have been implemented since 1997 and will yield their full GHG reduction benefits within the next few years.

This Plan demonstrates the completion of the third CCP milestone: the completion of the local Climate Action Plan. Amherst's Climate Action Plan is an outline of measures that the Town and other sectors of the community have completed or propose to enact, in order to achieve the greenhouse gas reduction target by 2009.

¹ The Greenhouse Gas Emissions Inventory and Forecast section of this report discusses these figures in greater detail.

Specific strategies outlined in this Plan are organized according to the following sections:

- Energy Use and Facilities
- Transportation
- Waste Management
- Land Use and Planning
- Community Education and Resources
- Implementation and Monitoring

Each section summarizes the findings of the 1997 inventory and is followed by specific emission reduction measures to be completed by 2009. It is important to note that numbers presented throughout this document reflect precision appropriate to individual calculations, but should be taken as approximate of actual conditions. The strategies are separated into three categories: *Town Strategies*, *Institutional Strategies*, and *Other Strategies*. The *Town Strategies* are those implemented directly by Town government. The *Institutional Strategies* apply to the University of Massachusetts, Amherst, and Amherst and Hampshire Colleges. Representatives from each of these three institutions are members of the Energy Conservation Task Force and helped to develop the Climate Action Plan. *Other Strategies* includes emission reductions measures that fall outside the jurisdiction of the Town or the three educational institutions.

Strategies for the commercial, residential, and other sectors of the community are not included in this Plan since they require individual and/or private actions that cannot be identified or measured within the scope of this Plan. However, these sectors can and do have a significant role in helping to reduce the Town's greenhouse gas emissions, and the Community Education and Resources section of this Plan seeks to involve the entire community in this effort. The Energy Conservation Task Force, in partnership with the Hitchcock Center for the Environment, which is the Town's local environmental education center, and other organizations and groups, will work to promote current and emerging community-wide initiatives.

The last two milestones in the CCP Campaign entail implementing and monitoring the outcomes of this Plan. Those strategies that are either currently underway, or the easiest to achieve, will be the first to be implemented. As individual goals and measures are met, the Energy Conservation Task Force will assess which strategy(ies) will next be acted upon. Assessment will include consideration of available resources, staffing and time. The Amherst community will be given the opportunity to participate in the process of goal-setting and prioritization prior to the annual budget season.

I. INTRODUCTION

There is widespread scientific consensus that the increasing quantity of gases in the atmosphere, primarily carbon dioxide (CO₂), methane (CH₄), nitrogen oxides (NO_x), and fluorocarbons, are causing shifting temperature patterns and increasing the frequency and severity of weather events on a global scale. The increased concentration of gases attributed to this climatic disruption, commonly known as global warming or global climate change, is directly linked to human activities. Burning large quantities of fossil fuels such as coal, oil, gas and wood, producing methane from landfills and agriculture, cutting forests, and destroying other ecosystems all contribute to an increased concentration of gases in the atmosphere which further intensify the earth's natural "greenhouse effect."

While few issues are so clearly worldwide with such far-reaching impacts, many of the most promising solutions to global climate change involve local initiatives that the Town can control. Amherst has committed to taking a leadership role in combating this problem on two levels: by increasing energy efficiency and by reducing greenhouse gas emissions to 35 percent below 1997 levels by 2009. By reducing emissions, the entire Amherst community will recognize substantial cost-savings, improved individual health and environmental quality. With this, effort Amherst will also contribute to reducing U.S. dependence on foreign oil, thus enhancing the overall security and quality of life in Amherst.

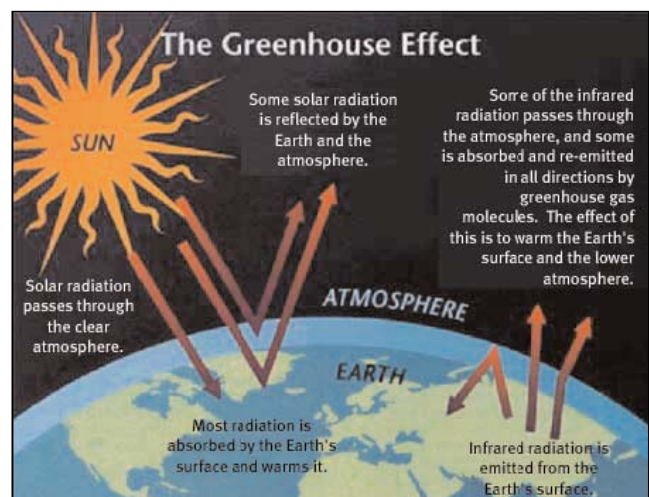
To meet this commitment effectively, we must develop a community consensus on the need and means to reduce greenhouse gas emissions. Reasons for this are clear:

- Climate change is directly affecting Amherst, and will continue to do so;
- The actions needed to reduce the buildup of GHGs will have many additional benefits, including increased energy reliability and security, cost-savings, cleaner air and water, and a higher quality of life;
- A concerted effort will recognize and complement actions already being undertaken locally to reduce GHG emissions; and
- A community approach will make Amherst eligible for resources which are readily available to support current and future actions to reduce greenhouse gas emissions.

This local Climate Action Plan is an outline of measures that the Town has already undertaken, and measures that the Town is encouraged to enact, in order to achieve the greenhouse gas reduction target by 2009. The first part of this document presents further information on climate change and outlines potential impacts of the phenomenon in Amherst and across the globe. Second, the Plan describes the Town's involvement with the CCP Campaign and the completion of the Amherst Greenhouse Gas Emissions Inventory in 2001. Third, the emissions reduction measures follow, and are broken out into the categories of transportation, energy use and facilities, waste management, land use and planning, and community education and resources. Lastly, a discussion of the Plan's implementation and monitoring, the last two milestones in the CCP Campaign, concludes the Plan.

THE SCIENCE OF GLOBAL CLIMATE CHANGE

According to the National Academy of Sciences, the Earth's surface temperature has risen by about one degree Fahrenheit in the past century, with accelerated warming during the past two decades. There is new and stronger evidence that most of the warming over the last 50 years is attributable to human activities. Human activities have altered the chemical composition of the atmosphere through the buildup of greenhouse gases, primarily carbon dioxide, methane, and nitrous oxide. While uncertainties exist about exactly how earth's climate responds to these gases, their heat-trapping properties are undisputed.



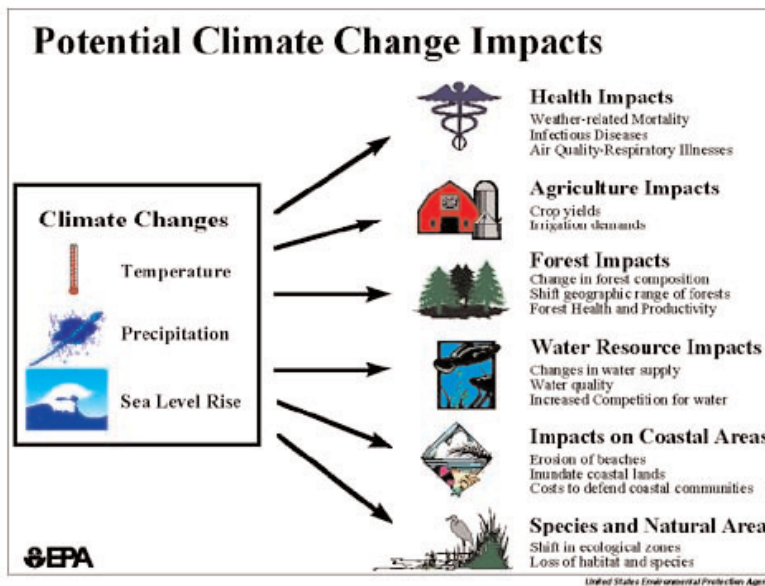
Energy from the sun heats the earth's surface and drives weather and climate; in turn, the earth radiates energy back into space. Atmospheric greenhouse gases (water vapor, carbon dioxide, and other gases) trap some of the outgoing energy, retaining heat somewhat like the glass panels of a greenhouse. Without this natural "greenhouse effect," temperatures would be much lower than they are now, and life as it is known today would not be possible. Instead, because of greenhouse gases, the earth's average temperature is a more hospitable 60°F. Problems have arisen, however, because the balance of the atmospheric concentration of greenhouse gases is being disturbed by an increase.

Since the beginning of the Industrial Revolution, atmospheric concentrations of carbon dioxide (CO₂) have increased nearly 30 percent, methane (CH₄) concentrations have more than doubled, and nitrous oxide (NO_x) concentrations have risen by about 15 percent. These increases have enhanced the heat-trapping capability of the earth's atmosphere. Sulfate aerosols, a common air pollutant, cool the atmosphere by reflecting light back into space, however sulfates are short-lived in the atmosphere and vary regionally.

Why are greenhouse gas concentrations increasing? Scientists generally believe that the combustion of fossil fuels and other human activities are the primary reason for the increased concentration of carbon dioxide. Plant respiration and the decomposition of organic matter release more than 10 times the CO₂ released by human activities. These releases were generally in balance over the centuries leading up to the Industrial Revolution, with carbon dioxide being adequately absorbed by terrestrial vegetation and the oceans.

The release of carbon dioxide by human activities has increased dramatically over the last few hundred years. Fossil fuels burned to run cars and trucks, heat homes and businesses, and power factories are responsible for about 98 percent of U.S. CO₂ emissions, 24 percent of methane emissions, and 18 percent of nitrous oxide emissions. Increased agriculture, deforestation, landfills, industrial production, and mining also contribute a significant share of emissions and to the decline in plant respiration. In 1997, the United States emitted about one-fifth of total global greenhouse gases.

Increasing concentrations of greenhouse gases are likely to accelerate the rate of climate change. Scientists expect that the average global surface temperature could rise 1 to 4.5°F in the next 50 years, and 2.2 to 10°F in the next century, with significant regional variation. Evaporation will increase as the climate warms, which will increase average global precipitation. Expected global environmental consequences include severe storms, floods, droughts, heat waves, sea-level rise, the expanded spread of disease and pest vectors, shifting migrations of ecosystems and species, and further stress on vulnerable species and ecosystems. In New England, resource-based industries such as agriculture, fisheries and forestry would experience significant impacts.



Estimating future emissions is difficult, because it depends on demographic, economic, technological, policy, and institutional developments. Several emissions scenarios have been developed based on differing projections of these underlying factors. By one estimate, for example, in the absence of emissions control policies, carbon dioxide concentrations are projected to be 30 to 150 percent higher than today's levels by 2100.

**KYOTO
PROTOCOL**
16 FEBRUARY 2005

emissions trading if they maintain or increase emissions of these gases. As of August 2005, a total of 153 countries, including the European Union, Canada and Japan, have ratified the agreement. Notable exceptions include the United States and Australia.

Thirty industrialized countries have committed to cutting their greenhouse gas emissions by approximately five percent below 1990 levels. While this represents an ambitious start, it is not ambitious enough to reduce future impacts on the global climate. Scientists estimate that a global reduction of 65 to 85 percent of current emissions is necessary to stabilize the global climate.

The effects of global climate change are already apparent in the Commonwealth. Over the past century, Massachusetts has experienced a two percent increase in temperature (2° Fahrenheit) and a 20 percent increase in precipitation. Projections for temperature increases of 4° Fahrenheit in the winter and spring, and 5° Fahrenheit in the summer over the next century have raised concern over elevated sea levels along the coastline. Public health concerns include a projected 50 percent increase in the number of heat-related deaths, increased symptoms of respiratory diseases such as asthma, and accelerated spread of disease through increasing populations of pest vectors.



The potentially damaging impacts of climate change on Massachusetts forests would also be significant. Major ice storms and changing weather patterns have severely impacted the New England maple syrup industry over the

October 2005 Amherst Climate Action Plan - 10 -

past century, creating ecological, economic and cultural concerns. Northern hardwoods, spruces, and fir trees could migrate 100 to 300 miles north, and would likely be replaced by southern and successional species. The trees producing some of the most spectacular fall foliage in the Commonwealth, an important part of the regional landscape heritage and tourism, may give way to the pressure of thinning forests attributed to an increased vulnerability to disease.

CITIES FOR CLIMATE PROTECTION & THE AMHERST ENERGY CONSERVATION TASK FORCE

The Cities for Climate Protection (CCP) Campaign is a program of ICLEI-Local Governments for Sustainability, a worldwide association of municipal, county, and other local governments addressing environmental problems at the local level. The CCP program was launched in response to increased awareness regarding the problem of global climate change. By participating in this program, Amherst has pledged to reduce its emission of greenhouse gases, primarily carbon dioxide and methane, two of the major contributors to this global phenomenon.

As of January 2005, there are 626 local governments involved around the world participating in the CCP Campaign, including over 150 in the United States and 21 in Massachusetts. U.S. participants account for 19 percent of total U.S. greenhouse gas emissions. In April of 2000, the Town of Amherst Select Board passed a resolution to join the CCP Campaign. In so doing, the Town of Amherst agreed to enter into the CCP's five-step process:

- 1. Complete a Greenhouse Gas Emissions Inventory and Report**
- 2. Set an Emissions Reduction Target**
- 3. Complete a Local Climate Action Plan to Reduce Greenhouse Gas Emissions**
- 4. Implement the Local Climate Action Plan**
- 5. Monitor the Impact of Emissions Reductions Measures**

Amherst has conducted an emissions inventory, and with this Plan is setting a reduction target with strategies and actions to achieve it. Many actions that reduce GHG emissions have already been initiated by the Town and by organizations and individuals in the community. An Energy Conservation Task Force comprised of representatives from the Town, the Hitchcock Center for the Environment, the University of Massachusetts Amherst, Hampshire College, Amherst College, and other members of the community met regularly for over two years to develop this Plan. The Energy Conservation Task Force was instrumental in shaping the Plan's principles, strategies, and actions.

An important aspect of the Climate Action Plan is that it is a living document. Processes for regular review of progress and reassessment of the Plan are incorporated into the five-step CCP process and in the implementation section of this Plan.



Cities for Climate Protection in Massachusetts

Amherst	Natick
Arlington	Newton
Barnstable	Northampton
Boston	Salem
Brookline	Shutesbury
Cambridge	Somerville
Falmouth	Springfield
Gloucester	Watertown
Lenox	Williamstown
Lynn	Worcester
Medford	

AMHERST'S GREENHOUSE GAS EMISSIONS INVENTORY AND FORECAST

The Greenhouse Gas Emissions Inventory was completed in the summer of 2001. The Inventory indicated that the equivalent of 320,960 tons of carbon dioxide (eCO₂) were released from sources in Amherst in 1997. Equivalent carbon dioxide levels represent the total quantity of CO₂ and methane emissions resulting from energy used, fuel used and landfill waste.³ Specialized software developed for CCP participants, discussed in the next section, was used to forecast emissions levels for 2009. If no actions are taken to address greenhouse gases in the Town, 318,940 tons of eCO₂ will be released in 2009. While 2009 total emissions are projected to be lower than total 1997 emissions, GHG emissions for all major sectors (residential, commercial, industrial, transportation, and waste) are forecasted to increase by 2009 (Table 1). The lower total emissions figure for 2009 results from reduced GHG emissions from the Amherst landfill. The landfill was in operation and producing significant emissions in 1997 (31,296 tons). It was closed in 2003, but the waste in place at the landfill (approximately 525,096 tons) continues to release methane on a decreasing curve as it decays. By 2009, the landfill will generate significantly lower GHGs (7,089 tons).

**1997 Community-wide emissions
Percentage by source**

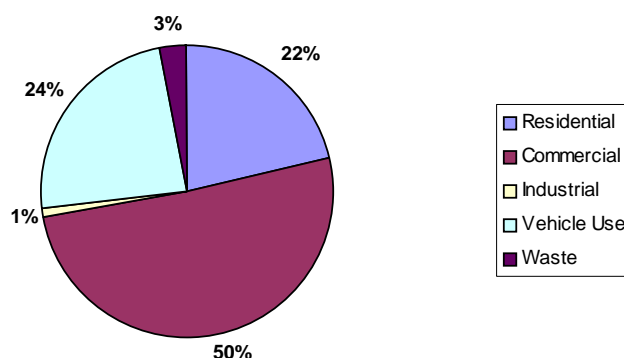


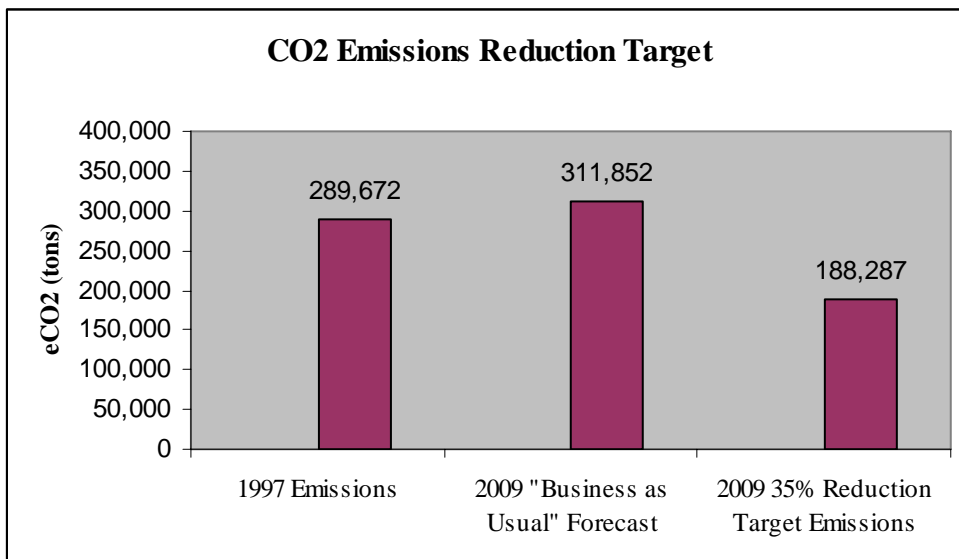
Table 1: Emissions Forecast

Sector	1997 Inventory	2009 Forecast
Residential	62,832 tons	65,353 tons
Commercial	147,608 tons	153,729 tons
Industrial	687 tons	708 tons
Transportation	69,248 tons	82,203 tons
Waste	9,297 tons	9,859 tons
Subtotal without Landfill	289,672 tons	311,852 tons
Other (Closed Landfill)	31,297 tons	7,089 tons
Total	320,960 tons	318,940 tons

The closed landfill notwithstanding, the other sectors combined are forecasted to increase by 22,188 tons. This increase is significant, and these sectors represent areas with great potential for energy efficiency improvements and cost-savings that can be achieved through relatively small changes in everyday business and routines. The following chart shows the 2009 forecasted amount of emissions with and without any actions taken, excluding the reduction impact of the landfill.

³ See Appendix E for the complete 2001 Greenhouse Gas Emissions Inventory

Amherst Town operations account for approximately four percent of the total eCO₂ produced in the Town. While the Town has generally done an excellent job of managing its resources, improvements can be made with the right investments. Investment into greenhouse gas reduction methods benefits the Town through both direct savings in electricity and fuel purchase costs, and by contributing to overall greenhouse gas reduction.



The vast majority of greenhouse gas emissions from the Town are from the activities of private residential, commercial, and institutional entities. The Emissions Inventory estimates that approximately 75 percent of total Town eCO₂ emissions come from these sectors. The influence of the Town on these emissions varies depending on the source of the emission. Through policy decisions about land use and development, investments in public transit, energy-efficient building practices, waste reduction and recycling programs, the Town can influence the behavior of non-Town entities both directly and indirectly.

CLEAN AIR AND CLIMATE PROTECTION SOFTWARE

Emissions data for the Amherst's GHG Emissions Inventory and the measures included in this [Climate Action Plan](#) were quantified using the Clean Air and Climate Protection (CACP) Software, a product produced for ICLEI to assist local communities with the CCP process. The software helps the user to (1) create an inventory and forecast emissions of greenhouse gases (GHGs) and criteria pollutants, namely carbon dioxide (CO₂), nitrogen oxides (NO_x), sulfur oxides (SO_x), volatile organic compounds (VOCs) and coarse particulate matter (PM₁₀); (2) evaluate policies to reduce emissions of these pollutants; and (3) prepare a GHG emission reduction action plan, with associated criteria pollutant co-benefits.

The software's components can be used independently to evaluate a single measure, or together to develop a comprehensive action plan. The software also generates reports that list the anticipated emission reductions of GHGs, NO_x, SO_x, VOCs, CO₂, and PM₁₀ from the measure(s) or action plan.

In developing an emissions inventory, a baseline year is chosen, and then energy use and waste data are entered by sector as records in the inventory database. The community analysis module is used to inventory community emissions as a whole, and the government analysis module inventories emissions from government-controlled operations. The software tracks emissions from each entry and sums them to create the inventory.

The measures function of the software is used to evaluate the impacts of specific GHG emission reduction measures. First, the implementation year, sector and type, and energy data associated with each individual measure are entered. The software then calculates emissions reductions associated with each measure.

A full climate action plan consists of a baseline emissions inventory, a forecast of emissions in the target year, a reduction target, and a quantified set of measures projected to produce emissions reductions that add up to the target. To develop this plan, both a baseline and forecast target year are first selected (e.g., 1997 and 2009) and the analysis modules are used to create an inventory for both years. An emissions reduction target is set to be

achieved against the baseline year by the target year, and the measures module is used to insert, evaluate and track multiple proposed policies and measures into the database. The climate action plan is generated using CACP reports features. In the process of developing the plan, one can periodically add up entered measures to track progress towards meeting the reduction target.

The CACP software has been developed for and is supported by ICLEI to allow local governments to meet the CCP milestones. Certain measures in this plan rely on assumptions and averages to reach estimations of GHG reductions; the guidance of ICLEI staff experienced with emissions reduction calculation was followed in these instances. The methodologies and assumptions behind measures are discussed in the individual measure sections.

II. THE CLIMATE ACTION PLAN: VISION, STRATEGIES & GOALS

The Town of Amherst has adopted the goal of reducing greenhouse gas emissions, for Amherst as a whole, by 35% below 1997 levels by the year 2009.

The Town of Amherst's Climate Action Plan sets forth actions the Town can take to reduce its greenhouse gas emissions. This Plan assesses the eCO₂ and cost-saving effects of measures that might be implemented through Town municipal operations, residential and institutional energy-saving programs, and transportation, waste management, land use and planning, and education initiatives. In cases where an eCO₂ reduction cannot be accurately forecast, environmental and economic benefits are highlighted.

The Town has set the goal of reducing eCO₂ emissions in 2009 to 35 percent below 1997 levels. In order to reach this target, 110,316 tons of eCO₂ must be eliminated between 1997 and 2009. Because the GHG Emissions Inventory and this Plan use 1997 as a baseline year, emissions reductions measures undertaken since 1997 are included in the Plan and reduction goal. These measures already in place account for 43,532 tons eCO₂ saved between 1997 and 2005, leaving a remaining 66,784 tons eCO₂ to be eliminated between 2005 and 2009. This is a reasonable and achievable goal, in part because many measures, particularly energy-saving facilities improvements undertaken by the Town, UMASS Amherst, and Amherst and Hampshire Colleges, have been implemented in recent years and will yield their full reduction benefits within the next few years.

The Town of Amherst commits to working to achieve the goal of reducing municipal GHG emissions by adopting the following strategies:

- Use Town leadership by example to spur community action;
- Develop a community-wide education campaign that engages all sectors and segments of the community;
- Build on existing efforts in the community;
- Engage the schools, colleges, and university;
- Network with other communities and organizations that are successfully engaging in local climate protection campaigns to learn and build from their programs and experience;
- Monitor progress and report the results; and
- Establish a committee or other entity to coordinate implementation.

There are many opportunities for the Town of Amherst to reduce its GHG emissions by improving the energy efficiency of its buildings and vehicle fleet, installing distributed energy systems to produce power, training staff to adopt more sustainable practices in the workplace, and reducing waste. By carrying out such actions and publicizing the results, the Town can lead by example.

This Plan does not suggest that the Town be responsible for the entire effort. The Town's role is to act as an initiator, convener, and leader. The Plan's success will ultimately rely on effectively motivating all sectors of the community to enact their own plans to reduce GHG emissions.

The strategies in this Plan are grouped into the following categories:

- **Energy Use and Facilities**
- **Transportation**
- **Waste Management**
- **Land Use and Planning**
- **Community Education and Resources**
- **Implementation and Monitoring**

Each section of the Plan outlines existing and proposed strategies for both the Town and relevant Commercial/Institutional sectors. Existing measures are either current initiatives that are being implemented, or are in the developmental stage since 1997. While these measures primarily consist of efforts to conserve energy

or reduce waste, other programs having that yield greenhouse reduction benefits in the pursuit of other goals are also recognized. Most proposed measures are new initiatives that have not yet been considered for implementation. Many of them follow the example of other local government emission reduction efforts, but have been restructured to address the unique needs of Amherst.

A. Energy Use And Facilities

THE ROLE OF ENERGY USE AND FACILITIES IN AMHERST'S GHG EMISSIONS

The design, construction, and maintenance of buildings have a tremendous impact on our environment and natural resources. There are more than 76 million residential buildings and nearly five million commercial buildings in the U.S. today. These buildings together use one-third of all the energy consumed in the U.S., and two-thirds of all electricity. By 2010, another 38 million buildings are expected to be constructed⁴. The challenge will be to build them so that they use a minimum of nonrenewable energy, produce a minimum of pollution, and cost a minimum of energy dollars, while increasing the comfort, health, and safety of the people who live and work in them.

Further, buildings are a major source of the pollution that causes urban air quality problems, and the pollutants that contribute to climate change. They account for 49 percent of sulfur dioxide emissions, 25 percent of nitrous oxide emissions, and ten percent of particulate emissions, all of which damage air quality. Buildings produce 35 percent of the country's CO₂, the primary pollutant impacting climate change⁵.

**Table 2: Amherst GHG Emissions
by Fuel Source (1997)**

Electricity	29%	82,622 tons eCO ₂
Coal	24%	69,600 tons eCO ₂
Gasoline	22%	62,288 tons eCO ₂
Oil	12%	35,329 tons eCO ₂
Natural Gas	8%	23,565 tons eCO ₂
Diesel	2%	6,072 tons eCO ₂

Traditional building practices often overlook the interrelationships between a building, its components, its surroundings, and its occupants. Traditionally constructed buildings consume more of our resources than necessary, negatively impact the environment, and generate a large amount of waste. The construction of a standard wood-framed home consumes over an acre of forest and creates an average of three to seven tons of waste. This type of building is often costly to operate in terms of energy and water consumption.

There are many opportunities to make buildings cleaner. As just one example, if ten percent of homes in the U.S. used solar water-heating systems, 8.4 million tons of CO₂ would be avoided annually⁶.

According to the Town's GHG Emissions Inventory, energy used to heat and cool buildings, provide lighting, and power equipment accounted for 69 percent of Amherst's GHG emissions in 1997. Most of this was from the commercial/industrial sector, which accounted for 50 percent with 147,608 tons of eCO₂. To achieve the goals of this Plan, this source of GHG emissions must be addressed.

Given that existing buildings consume the bulk of energy, retrofitting them with more efficient technologies should be a priority. Energy should be used to maximize the community's well-being, taking into consideration technological effectiveness, cost, and environmental impact. Many of the emissions reduction measures in this section have been implemented since 1997 or are substantially underway. They focus both on approaches to make buildings and facilities more energy and cost-efficient, and on ways to promote the development and increased use of renewable energy technologies such as solar, wind, biomass, geothermal.

⁴, ⁵, ⁶ Source: Massachusetts Technology Collaborative, www.mtpc.org

Various federal and state tax incentives are available to Massachusetts businesses, institutions, and residents in support of renewable energy projects. They include:

- The federal Modified Accelerated Cost Recovery System for wind, solar, and geothermal properties, which allows businesses to recover investments through depreciation deductions;
- The federal Renewable Energy Tax Credit of 1.5 cents per kwh; applicable to wind, solar photovoltaic, and biomass;
- A federal solar tax credit of 10 percent of purchase and installation costs;
- A Massachusetts exemption from excise taxes for solar energy systems on commercial and industrial properties;
- A Massachusetts 100 percent income tax deduction for solar energy systems on commercial and industrial properties;
- A 15 percent Massachusetts tax credit for residential renewable energy systems, up to a maximum of \$1,000;
- A Massachusetts sales tax exemption for residential renewable energy systems; and
- Statewide exemption of renewable energy systems from property taxes, whereby that installation of a renewable energy system does not increase the assessed value of a property.

Grants offered through non-profit organizations, such as the Massachusetts Center for Ecological Technologies, present another avenue available to businesses, institutions, and residents seeking financial support of renewable and environmentally-friendly energy projects.

THE REGIONAL GREENHOUSE GAS INITIATIVE

In August 2005, the Amherst Select Board approved the efforts of the Energy Conservation Task Force to support the Regional Greenhouse Gas Initiative (RGGI). Developed by the Northeast Governors and led by New York Governor George Pataki, the RGGI is a strategy multi-state effort aimed at creating a program to control emissions of CO₂ from the electricity sector. The Governors and their environmental and energy agency leaders are developing a model rule that each state will implement and a system to trade CO₂ permits among power plants in different states. In supporting RGGI, which aims to have program design agreement by the end of 2005, Amherst joins the mayors of Newton, MA, Keene, NH, and New Haven, CT in urging their state governments to move the developing program model forward. This Climate Action Plan sets out the strategies to achieve Amherst's CO₂ emissions reduction goal of 35 percent below 1997 levels by 2009. At the regional level, the New England governors and the Eastern Canadian premiers issued a Climate Change Action Plan in August 2001, which calls for the reduction of greenhouse gases to ten percent below 1990 levels by 2020. The efforts of the RGGI and the regional cap-and-trade program will assist all participating states and municipalities in reaching their local goals.



TOWN ENERGY USE & FACILITIES STRATEGIES

Town Strategy: Amherst's Renewable Energy Campaign Projected GHG Reduction by 2009: Unknown Implementation year(s): 2005

In August 2005, the Amherst Select Board voted unanimously to support Amherst's participation in the Massachusetts Technology Collaborative's (MTC) Clean Energy Choices program. This program allows all Amherst residents and businesses the opportunity to support clean energy technologies through their collective buying power. Although the option to receive energy directly from renewable sources is not yet available to Amherst Western Massachusetts Electric Company (WMECO) customers, this campaign allows residents and businesses to make a tax-deductible donation supporting wind energy within the state. For every \$50 an Amherst household or business spends through the campaign, \$50 will be awarded by the MTC to the Town to support green energy building projects. A portion of the funding received will be devoted to the construction of a photovoltaic solar system at The Hitchcock Center for the Environment, which resides in a town-owned building. This strategy will not only allow Amherst to continue to support clean energy, but will also provide funding for potential clean energy projects around the state.

The goal of Amherst's Renewable Energy Campaign is to enroll three percent of Amherst household (approximately 300) in the program by December 31, 2005. If this goal is met, MTC will award the Town an additional bonus grant of \$50 per participant, for a total grant amount of \$30,000.

Town Strategy: Department of Public Works Energy Reduction Program Projected GHG Reduction by 2009: 1,613 Tons eCO₂ Implementation year(s): 1997-2009

The Amherst Department of Public Works (DPW) has undertaken extensive energy-saving and emissions-reduction measures at several of its facilities since 1997. At the DPW Headquarters, the following measures were undertaken in 2000: all new, 28-Watt lighting replaced 100-Watt outside lighting; all inside lighting was replaced or converted to 32-Watt plus ballast from 40 Watts; motion sensors were installed where appropriate for lighting control; and a programmable thermostat was installed. According to the GHG Emissions Inventory, DPW electricity use in 1997 was 58,612 mmbtu and light fuel oil use was 12,613 gallons. A 25 percent reduction in the use of each energy source between 1997 and 2009 would entail reducing electricity consumption to 43,959 mmbtu and oil consumption to 9,460 gallons. These reductions would result in the savings of approximately 1,613 tons of eCO₂ annually.

Town Strategy: Amherst Wastewater Treatment Plant Energy-Efficiency Upgrades Projected GHG Reduction by 2009: 837 Tons eCO₂ Implementation year(s): 1997-2009

Multiple energy efficiency measures have been undertaken since 1997 at the town's main wastewater treatment plant, which was constructed in 1976. In 2004, three electric heaters were replaced with heat pumps, which draw heat from waste water and reuse it to heat the building, and three 40-horsepower aerator motors were replaced with high-efficiency (Hi-E) motors. In 2003, three new pump stations were installed with Hi-E motors; two skimming pumps, which have smaller, Hi-E motors were installed; and variable frequency devices (VFDs) were installed. Many electric motor-driven devices operate at full speed even when the loads they are serving are less

Cities Go for Green Power

- Santa Monica, California purchases 100% of the electricity used by the municipal government from renewable sources.
- The City of Chicago has contracted with Consolidated Edison to purchase 10% of its municipal electricity from renewable sources in the first year of the contract and 20% within 5 years.
- The City of Los Angeles is purchasing 10% of its municipal power needs from renewable sources.

than their capacity. A part load control is used to match the output of the device to the load. Examples include pumps, fans, conveyors, injection molding machines, air compressors and chillers. Many part load control strategies waste energy. The most efficient method of part load control, resulting in minimal wasted energy, is the variable frequency drive (VFD). VFDs accomplish part load control by varying electric motor speed. Energy savings of 50 percent or more over other part load control strategies are common. Compared with physical changes that can be made to motors to adjust their speed, frequency adjustment is convenient, cost-effective, and precise. Additionally, DPW received two electric cars at no cost from Daimler Chrysler. These are used by workers for short trips around the plant. In 2002, programmable thermostats were installed in the facility.

In 1999, influent pump One was upgraded with a VFD, a smaller motor, and a Hi-E motor; influent pumps Two and Three were upgraded with VFDs and Hi-E motors in 2000. Also in 1999, two recirculating pumps were upgraded with smaller pumps, motors, and VFDs; two waste pumps were upgraded with smaller Hi-E motors, pumps, and VFDs; and dissolved air floatation units were replaced with a Gravity Belt Thickener, which requires much less associated horsepower. In 1997, DPW replaced a 100-horsepower continuously running pump with a five-horsepower pump in the plant water system; the primary pump was upgraded with a smaller pump and a Hi-E motor; and all lighting was converted from 40 Watt to 32 Watt and ballast in 1997.

At the Centennial Water Treatment Plant, well One was upgraded with a new Hi-E motor and VFD in 2004; the 40-horsepower motor at well Two was replaced with an equivalent Hi-E motor in 2000, and a new Hi-E motor and 200-horsepower VFD in 2003. In 2000, three 20-horsepower motors were replaced with Hi-E motors and VFDs, and all lighting was converted from 40 Watt to 32 Watt and ballast.

At the Atkins Water Treatment Plant, motion sensors were installed where appropriate for lighting control. According to the Emissions Inventory, Town water and sewage facilities consumed 15,560 mmbtu of energy in 1997. Combining the extensive measures implemented since 1997 and those planned before 2009, a 50 percent reduction in energy consumption by the Town's water and sewage facilities would translate into an eCO₂ savings of approximately 837 tons.

Town Strategy: Light-Emitting Diode Traffic Signals
Projected GHG Reduction by 2009: 170 Tons eCO₂
Implementation year(s): 2002-2009

Light-emitting diodes (LEDs) are highly efficient alternatives to the incandescent bulbs that have been used in traffic signals over the years. A 20-Watt LED lamp has the same light output as a 135-Watt incandescent bulb, resulting in energy-savings of 115 Watts. LED lights have also been estimated to last 6 to 10 times longer than incandescent lamps. According to the Emissions Inventory, total electricity consumption for the town's 12 traffic signals was 96,422 kWh in 1997. Assuming the number of traffic signals remains relatively constant, a 40 percent reduction in electricity use would conserve approximately 170 tons of eCO₂ by 2009.

Town Strategy: Town Employee Energy Education Program
Projected GHG Reduction by 2009: 86 Tons eCO₂
Implementation year(s): 2006

An education program will be developed to increase Town employees' awareness of energy conservation issues and practices. The link between their implementation of practical measures, energy-savings, and CO₂ reduction will be highlighted. By providing an educational forum and highlighting specific measures, employees will be empowered to modify their individual energy use and identify financial and environmental savings to the Town. For example, employees would be encouraged to turn off office, restroom, and other lights when not in use or when natural lighting is sufficient. Turning off desktop computers during lunch breaks and at the end of day would also be encouraged. According to the 1997 Emissions Inventory, electricity use in town buildings was 15,879 mmbtu. In 1997, 580 employees (not including school employees) required approximately 27.4 mmbtu each. If each employee reduced his or her yearly energy consumption by five percent, or 1.37 mmbtu, a 795 mmbtu reduction in consumption would result, as well as an eCO₂ reduction of approximately 86 tons.

Town Strategy: Purchase Efficient Equipment and Appliances
Projected GHG Reduction by 2009: 7 Tons eCO₂
Implementation year(s): 2006-2009

Institute policies for all Town purchasing in which all energy-consuming products such as computers will, at a minimum, meet U.S. EPA ENERGY STAR® criteria standards, where applicable. Publicize this policy to residential users. Keep and periodically publish a current list of categories of commonly used appliances and their energy consumption ranges. The Town will undertake periodic energy audits to evaluate existing levels of energy efficiency and identify new steps that could be taken to improve efficiency. By eliminating 20,000 kWh of electricity use through replacing older equipment and appliances with more efficient ones, approximately seven tons of eCO₂ would be saved by 2009.



The EPA launched its Energy Star program in 1992 to raise consumer awareness about energy performance in products and buildings. Currently, 30 product categories, such as lighting, consumer electronics, roofs, and heating and cooling equipment, are rated by the EPA. Those products that carry the Energy Star label are significantly more efficient than required by minimum government standards. Energy Star buildings are in the nation's top 25% in terms of energy efficiency. Energy Star partners, which can be businesses or other types of organizations, have entered into agreements with the EPA to undertake energy efficiency improvements and promote good energy practices.

INSTITUTIONAL ENERGY USE & FACILITIES STRATEGIES

AMHERST COLLEGE

Amherst College Strategy: General Conservation Strategies
Projected GHG Reduction by 2009: Unknown
Implementation year(s): 2001

Energy Manager

The three colleges are supporting a new Energy Manager who develops and coordinates efforts to reduce energy consumption on campus. The Energy Manager develops initiatives based on his research in the field and provides basic analysis of initiatives from in house presented at Energy Task Force meetings and other venues.

Energy Conservation Task Force

Amherst College has an Energy Conservation group that meets monthly. The College Task Force includes the Energy Manager and supervisors with their mechanics from the shops whose work affects the amount of energy used on campus. The Task Force is challenged to find ways of improving the energy efficiency on campus.

Energy Conservation Management Strategies and Utilities Rebates

- Adding lighting controls in the Athletic Facility to reduce their "on" time
- Upgrading light fixtures
- Replacing motors with high efficiency motors
- Operating the Steam Plant to improve its efficiency
- Expanding the reach of the Energy Management System to bring more HVAC systems under tighter control
- Adding variable frequency drives to motors
- Pursuing renewable energy sources (wind, water)

Amherst College Strategy: Energy Code Compliance
Projected GHG Reduction by 2009: 60 Tons eCO₂
Implementation year(s): 2001

Effective in 2001, all new building construction at Amherst College is being done in compliance with the Massachusetts Energy Code, 6th Edition. Chapter 34 (Rules on Renovations) allows some latitude in compliance

with the energy code in older buildings. In exceeding this requirement, the College installs efficient equipment, material, and insulation wherever possible, including in renovated buildings. This measure saves approximately 5,500 gallons of heating fuel and approximately 60 tons of eCO₂ annually⁷.

Amherst College Strategy: Air-To-Air Heat Exchangers

Projected GHG Reduction by 2009: 13 Tons eCO₂

Implementation year(s): 2001

Recent work to improve the dormitories at the college has provided an opportunity to design ventilation systems to include air-to-air heat exchangers (also called heat recovery ventilators) that recapture heat carried in exhausted air. Residential air-to-air heat exchangers typically recover 60 to 75 percent of the heat in exhaust air. Most of the dormitories renovated since 1995 have this heat recovery installed. Among those renovated since 1997, the College has netted a two percent reduction in heating fuel use, which will translate into a reduction of approximately 13 tons of eCO₂ annually.

Amherst College Strategy: Efficient Windows and Insulation

Projected GHG Reduction by 2009: 149 Tons eCO₂

Implementation year(s): 1997

All windows and insulation installed in new buildings at the college meet industry Best Practice standards for high performance and efficiency. By using more efficient materials, the college reaps the double benefit of saving energy and of providing more serviceable and comfortable facilities for its staff and students. This measure has resulted in a five percent reduction in heating fuel use and eliminated 149 tons of eCO₂ annually.

Amherst College Strategy: Centralized Air Conditioning System

Projected GHG Reduction by 2009: 128 Tons eCO₂

Implementation year(s): 1999

Since 1999, the air conditioning system at the College has been continually upgraded towards the goal of being a centralized, energy-efficient plant. Year-round air conditioning has become more important because of increased summer programming at the College. Large chillers use less than half the energy of smaller, disbursed chillers to cool. A reduction in the number of outdoor cooling towers that need chemical treatment is a collateral benefit of this central plant. This consolidation has reduced electrical use by two percent, saving 128 tons of eCO₂ annually.

Amherst College Strategy: Cogeneration plant

Projected GHG Reduction by 2009: Unknown

Amherst College is studying the feasibility of building a cogeneration plant that will allow the College to generate its own electricity and become less dependent on the utility grid. A cogeneration plant generates electrical and thermal power simultaneously by utilizing the waste heat from a gas turbine to generate steam. This highly efficient means of producing electricity is expected to substantially reduce CO₂ production.

HAMPSHIRE COLLEGE

Hampshire College has undertaken aggressive measures to improve energy efficiency in student dormitories, academic buildings, and other facilities. These measures have resulted in a 28 percent reduction in energy use between 1990 and 2000.⁸

⁷ All Amherst College Energy Use and CO₂ reduction figures were provided by Aaron Hayden, Amherst College Capital Projects Manager and Campus Utilities Engineer and Task Force member

⁸ Reductions achieved prior to the 1997 baseline of the Emissions Inventory are not figured into the Climate Action Plan.

Hampshire College Strategy: Convert Electric Heating To Natural Gas
Projected GHG Reduction by 2009: Unknown
Implementation year(s): 2001-2009

Hampshire College was constructed in 1970 with 100 percent electric space heating systems. Conversion to natural gas space heating is an ongoing process, and several major academic buildings and student residences were converted to natural gas hot water heating during the 1980s and early 1990s. This has dramatically decreased annual usage from a high of 16 million kWh in 1974 to 7.5 million kWh in 2003. During this time the campus has increased in size.

The following electric to gas water heating conversions have been undertaken since 1997: the Writing Center (2001); the 260-bed Dakin Dormitory, saving near \$40,000 per year and 1.5 million kWh per year (2001-2004); and four apartments in Enfield Dormitory (2003-2004).

Between 2005 and 2009, one academic building and two apartments in Merrill dormitory will be converted using 97 percent efficient boilers, which should cut about 360 kWh from demand during peak heating months and about 215,000 kWh during these months. The savings, less the cost of gas, could be as high as \$35,000 a year.

Hampshire College Strategy: Programmable Thermostats and Remote Temperature Monitoring for Dormitories
Projected GHG Reduction by 2009: 37 Tons eCO₂
Implementation year(s): 2002

The entire campus is controlled by an Energy Management System (EMS) that adjusts set points based on outside air. EMS also sets thermostats back when buildings are not occupied, changes the speed of fan motors based on occupancy levels, and uses economizers to cool buildings during cooler weather. It opens and closes fresh air dampers in academic buildings based on CO₂ readings. Student rooms in the Dakin Dormitory, for example, have individual thermostats that can be adjusted only within a range of 55-72°F. Each room is monitored remotely by an energy manager, who checks daily for any unusual spikes or drops in temperature. This efficiency measure results in an estimated reduction of 100,000 kWh, saving approximately 37 tons of eCO₂ annually.

Hampshire College Strategy: Air-to-Air Heat Exchangers in Academic Buildings
Projected GHG Reduction by 2009: 13 Tons eCO₂
Implementation year(s): 2002-2007

Heat recovery units are installed in all new renovations. In the Art Barn, Film and Photo, and in two residential units in Enfield, for example, heat recovery recaptures some of the lost heat from exhausting 100 percent of the return air. This measure saves 13 tons of eCO₂ annually.

Hampshire College Strategy: Variable Frequency Drives (VFDs) Installed Throughout Dormitories and Academic Buildings
Projected GHG Reduction by 2009: 21 Tons eCO₂
Implementation year(s): 1997

Many electric motor-driven devices operate at full speed even when the loads they are serving are less than their capacity. A part load control is used to match the output of the device to the load. Examples include pumps, fans, conveyors, injection molding machines, air compressors and chillers. Many part load control strategies waste energy. The most efficient method of part load control, resulting in minimal wasted energy, is the variable frequency drive (VFD). VFDs accomplish part load control by varying electric motor speed. Energy-savings of 50 percent or more over other part load control strategies are common. Compared with physical changes that can be made to motors to adjust their speed, frequency adjustment is convenient, cost-effective, and precise. All major motors were outfitted with VFDs in 1997, saving 57,120 kWh per year, and approximately 195 tons of eCO₂ annually.

Hampshire College Strategy: Renovation Improvements
Projected GHG Reduction by 2009: 73 Tons eCO₂
Implementation year(s): 1997-2007

Building renovations since 1997 have included energy-efficiency measures such as improved daylight capturing, HVAC duct improvements, and compliance with high-efficiency codes for windows, sealants, and doors. Future plans include upgrading existing fluorescent lighting to more efficient bulbs and ballasts, and existing 1000 Watt metal halide lamps to efficient fluorescent lighting. As they need to be replaced, exit lights are changed from incandescent to light-emitting diode (LED) fixtures, and domestic hot water heaters in apartments are changed to tanks. These measures have saved an average of 200,000 kWh annually, and will save approximately 73 tons of eCO₂ annually.

Hampshire College Strategy: Continue to Work with Science Department Faculty and Students to Monitor Energy Use and Test New Initiatives
Projected GHG Reduction by 2009: Unknown
Implementation year(s): Ongoing

Two residential apartments are set up as test models for faculty and students to experiment on different ways to conserve energy. The Energy Management System (EMS) for these model units is in place and accessible online.

UNIVERSITY OF MASSACHUSETTS, AMHERST

UMASS Computerized Energy Management System

Since 1996, UMASS has been expanding its computerized energy system via more efficient and centralized controls and timers. Implemented in stages from 1996 on, this measure is currently eliminating 6.3 million kWh per year from campus electrical use and 72,000,000 lbs steam per year from thermal energy use. This translates into a savings of 2,400 tons of coal, 27,000 thousand cubic feet of natural gas, and 28,400 gallons of light fuel oil each year. Total savings are \$890,000 and 9,348 tons of eCO₂ annually. This strategy is not factored into the Climate Action Plan because it was implemented prior to the 1997 baseline, however the cost-savings and GHG reduction exemplify the effectiveness of a comprehensive approach to energy management within a large institution.

UMASS Amherst Strategy: Physical Plant Energy Conservation Project
Projected GHG Reduction by 2009: 56,000 Tons eCO₂
Implementation year(s): 2004-2007

UMASS Amherst's Physical Plant is involved in a \$43 million energy conservation project for the campus. The Capital Improvement project will be funded by utility savings over a ten-year period. A major goal of the project is to improve campus building performance and address deferred maintenance while reducing operating costs. This project was funded through a performance contract, where the contractor guarantees the performance of the measures and is required to make up for any shortfalls. The project includes lighting and lighting controls, new chillers and other building mechanical improvements, water conservation measures including low flow toilets, and steam and electric distribution improvements including building metering. In addition to the physical modifications, UMASS hopes to reinforce the economic and environmental importance of energy and water conservation in the campus community through various outreach programs. The construction phase began in 2004 and completion will take up to two years. The measure will reduce annual eCO₂ emissions by approximately 56,000 tons.⁹

⁹ All UMass Amherst Energy Use and CO₂ reduction figures were provided by Jason Burbank, UMass Energy Engineer and Task Force member

UMASS Amherst Strategy: New Gas/Oil-Fired Central Heating Plant
Projected GHG Reduction by 2009: 45,777 Tons eCO₂
Implementation year(s): 2008

A new gas and oil fired central heating plant is under design which will replace the existing coal plant. The existing plant burns an average of 35,000 tons of coal per year. This heating value will be replaced primarily with natural gas. Additionally, the new plant will cogenerate approximately 75 percent of the campus electrical use. This will utilize all of the waste heat from the electrical generation process to heat and cool the campus. Since very few central power plants on the grid utilize this waste heat, offsetting grid-generated electricity in this manner saves overall fuel. Roughly three fifths of the savings are from fuel switching, with the remainder from cogeneration. The measure will reduce eCO₂ emissions by approximately 45,777 tons annually.

UMASS Amherst Strategy: Variable Air Volume Conversion - Lederle Graduate Research Center Tower
Projected GHG Reduction by 2009: 3,235 Tons eCO₂
Implementation year(s): 1998

Installed in 1998 and funded by Western Massachusetts Electric (WMECO), this measure reduced the outside air ventilation rate to the laboratory tower of the Graduate Research Center and removed a number of intermediate exhaust fans. Savings of electrical energy from reduced fan horsepower and cooling of outside air were obtained. Heating fuel savings were obtained from reduced winter heating of outside ventilation air. This measure has saved 2,101,000 kWh and 25,000,000 lbs of steam annually. Fuel savings are 840 tons coal, 9,500 thousand cubic feet of natural gas, and 9,800 gallons of light heating oil annually. Cost-savings are \$305,000 annually, and this measure will result in the elimination of approximately 3,235 tons eCO₂ annually.

UMASS Amherst Strategy: Electric Chiller Replacement & Variable Flow Pumping - Lederle Graduate Research Center
Projected GHG Reduction by 2009: 685 Tons eCO₂
Implementation year(s): 1997

Installed in 1997 and funded by WMECO, this project replaced an aging electric chiller with new energy-efficient units and reduced chilled water pumping costs in the Graduate Research Center. This measure saves 1,866,000 kWh, \$116,000, and approximately 685 tons of eCO₂ annually.

UMASS Amherst Strategy: Replacement of 100-Ton Chiller with Heat Exchanger in Winter – Palmer Research Center
Projected GHG Reduction by 2009: 59 Tons eCO₂
Implementation year(s): 2000

Installed in 2000, this project provided a heat exchanger that allows direct cooling of the building's chilled water system with cold cooling tower water. This bypasses the electric chiller in cool weather, saving 160,000 kWh, \$9,900, and an estimated 59 tons of eCO₂ annually.

UMASS Amherst Strategy: Switch to Energy-Efficient Electrical Products and Materials for Maintenance and Repairs
Projected GHG Reduction by 2009: 15 Tons eCO₂
Implementation year(s): 2005

For energy consuming equipment replacements, use of energy efficient units is expected to save 40,000 kWh, \$2,500, and 15 tons eCO₂ annually.

OTHER ENERGY USE & FACILITIES STRATEGIES

Other Strategy: Hitchcock Center for the Environment's Green Building Project

Projected GHG Reduction by 2009: Unknown

Implementation year(s): 2005-2009

The Hitchcock Center for the Environment is currently in the planning phase of a major green building renovation and expansion project. This includes greening the building to define the Center as a unique demonstration site for emerging green building technology with active education for all ages on sustainability. The Hitchcock Center's goal is to create an energy neutral building through innovative design and technology.

Other Strategy: WMECO's Renewable Energy Initiatives

Projected GHG Reduction by 2009: Unknown

Implementation year(s): 2006-2009

WMECO is working to offer more renewable energy options like solar, wind, and hydropower for their customers, the environment and our future. They are dedicated to supporting research, development and promotion of renewable energy technologies.

WMECO pioneered the Solar Avenue program in western Massachusetts, helping customers across the region take advantage of the power of the sun's power. This pilot program alone reduced reliance on traditional energy sources such as coal and nuclear fuel by 43,000 kilowatt hours each year, saving customers close to \$1,700 in annual electricity costs and reducing emissions into the environment by 56,000 pounds a year.



TOTAL ESTIMATED GHG REDUCTION FOR ENERGY USE & FACILITIES = 108,978 TONS

B. Transportation

THE ROLE OF TRANSPORTATION IN AMHERST'S GHG EMISSIONS

The GHG Emissions Inventory estimates that vehicle use contributes about 24 percent of eCO₂ emissions in Amherst. A significant portion of this (10 percent) is generated by private automobiles. While the Town cannot control the driving habits of individuals, it can ensure that attractive alternatives to automobile use are available. These include reliable and convenient public buses, on-demand transportation (i.e. vans, taxis, and Zip Cars), and safe bicycling and walking. The Town's vehicle fleet contributes approximately 14 percent to the municipal operations emissions, leaving slightly more than half of the Town's total emissions from transportation under the direct control of the Town government. On another level, the commuting habits of Town employees, discussed later in this section, present another way in which the Town can influence the level of emissions generated by transportation uses.

More than half of the petroleum consumed in the United States is used for the operation of private cars and trucks. A reduction in the use of petroleum-based vehicles in Amherst could significantly reduce local production of GHGs. A commitment to making environmentally responsible transportation choices available offers a powerful means for protecting the local air quality and reducing our production of GHG.

Amherst has committed to reduce its GHG emissions by 35 percent below 1997 levels by 2009. This is a reasonable, achievable goal for Amherst. U.S. Census 2000 Journey to Work data, shown in Table 3, demonstrates the extent to which residents recognize the inherent benefits of multi-modal transportation. Amherst's large university and college population (18,556 students in 2000) combined with the central locations of the Amherst College and UMASS campuses contribute to the unusually high percentage of residents who walk and bicycle to work.

Table 3: Journey to Work	Amherst	United States
Mean Travel Time	18 minutes	25 minutes
Drive Alone	53%	76%
Carpool	7%	12%
Walk to Work*	24%	3%
Use Public Transportation	7%	5%
Bicycle to Work	2%	0.5%
Work at Home	5%	3%

*Includes student residents with on-campus jobs

Source: U.S. Census Bureau, Census 2000 Summary File 3, Matrices P30, P31, P33, P34, and P35

Amherst residents who do use cars to get to work have a significantly shorter mean travel time to work (18 minutes) than the average American (25.5 minutes). At seven percent, residents are carpooling to work at almost half the rate of the average American. Given the otherwise high utilization of drive-alone alternatives among commuters, this figure presents an opportunity to create carpooling incentives within this Plan while reflecting realities of job distribution within the Pioneer Valley. Increasing numbers of vehicles are beginning to impact the Town's transportation-related GHG profile. Nine percent of Amherst residents do not own a car at all (compared with 11 percent nationally), while nearly 14 percent of Amherst households own three or more cars (compared with 21 percent nationally).¹⁰ This increase in vehicle ownership reflects a larger trend in the country as a whole, and emphasizes the importance of integrating viable transportation alternatives into Town policy.

In addition to increased vehicle ownership among residents, increased vehicle miles traveled throughout the town are also significant to the GHG picture. The Pioneer Valley Planning Commission (PVPC), the regional planning body for the Pioneer Valley region, which encompasses 43 cities and towns in the Hampden and Hampshire county areas, estimates that annual vehicle miles traveled in Amherst will increase 31 percent to 350,447 by 2010 (2009 estimates were not available) from 266,615 in 2000.



AMHERST'S PUBLIC TRANSPORTATION COMMITTEE

The Public Transportation Committee was established by Town Meeting vote in April 1995. The Energy Conservation Task Force has been working closely with this committee to develop this portion of the Climate Action Plan. The purposes of the Public Transportation Committee include:

- Reviewing all proposals concerning public transportation policy;
- Advising the Select Board and the Town's representative on the PVTa;
- Reporting to Town Meeting on any article that concerns public transportation; and
- Conducting specific studies concerning public transportation.

The committee maintains a permanent subcommittee concerning bicycling, whose purposes include:

- Fostering public awareness of the rules for safe bicycling;
- Reviewing and making recommendations on Town Bylaws and other laws affecting bicycling in Amherst;

¹⁰ 2001 Nationwide Household Transportation Survey (NHTS)

- Recommending the designation and development of bicycle parking facilities and routes, both commuter and recreational, within the town; and
- Reviewing plans for subdivisions or development of land, and the construction or rehabilitation of sidewalks, roads, and intersections within the town.

The Public Transportation Committee aims to ensure that land development and commercial and residential construction incorporate amenities which promote bicycling, pedestrian activities, and the use of public transportation. The committee advocates for continued town funding for public transportation and works with local transit representatives to ensure that the provision of transit services meets the specific needs of Amherst residents.

AMHERST'S PUBLIC TRANSPORTATION SYSTEM

The Pioneer Valley Transit Authority (PVTa), the regional transit operator, runs 14 routes connecting Amherst with neighboring Belchertown, Hadley, Northampton, South Deerfield, South Hadley and Sunderland through the local operator, UMASS Transit Service. Service is provided between many Amherst neighborhoods and outlying communities from Sunderland to Belchertown, and points in between. Shuttle service is provided on the campus of the University of Massachusetts with connections easily made for Mt. Holyoke College, Amherst College, Hampshire College, and Smith College in Northampton.

Staffed by nearly 150 college students and managed by transportation professionals, UMASS Transit carries nearly 19,000 passengers every day for the PVTa. UMASS provides no-fare bus service during the school year to students, faculty and staff of the Five Colleges, low-fare bus service to the public, members of the University community needing special transportation, and field trip services to student groups and University departments. Innovations such as front-mounted bicycle racks on buses and bus schedules and maps available for palm-top computers help ensure that mass transit remains an attractive alternative to driving.

TOWN TRANSPORTATION STRATEGIES

Town Strategy: Green Fleet Policy

Total Projected GHG Reduction by 2009: 265 Tons

Implementation year(s): 2004 - 2009

In the spring of 2002, Amherst Town Meeting adopted a resolution stipulating that when the Town purchases motor vehicles for its municipal operations, each vehicle purchased must be the most fuel-efficient model available and/or the model with the lowest emissions rating available that will fulfill the intended municipal function.

This policy keeps in place other normal procurement criteria, including price and reliability, while encouraging departments to explore environmentally responsible ways to meet their transportation needs. It promotes the acquisition of vehicles that have high fuel economy, operate on alternative fuels such as biodiesel, natural gas, or electricity, or utilize alternative sources of energy such as human power. It also encourages efforts, such as those being undertaken by the Superintendent of Public Works, to convert existing fleet vehicles to cleaner-burning biodiesel fuel.

This resolution has helped the Town to realize significant savings in fuel costs while demonstrating the Town's active concern for the quality of the environment. Through the acquisition of vehicles with high fuel efficiency and low emissions, the Town provides leadership and encouragement to residents and employers who are inclined to purchase such vehicles.

The strategies discussed below would further reduce the annual GHG emissions of the Town's vehicle fleet by 265 tons of eCO₂.

Town Green Fleet Strategy: Substitute biodiesel for oil-based diesel in municipal fleet and school buses
Projected GHG Reduction by 2009: 133 Tons eCO₂
Implementation year(s): 2007

According to the GHG Emissions Inventory, the baseline diesel consumption in 1997 for municipal fleet and school buses was 60,276 gallons. Even while maintaining the current fuel efficiency and level of use, converting the municipal fleet to biodiesel would reduce eCO₂ production by approximately 133 tons annually. Using local diesel (\$2.40/gallon) and biodiesel (\$2.30/gallon) price averages from July 2005, the cost savings associated with fuel consumption would be approximately \$6,000¹¹.

Town Green Fleet Strategy: Improve gas mileage for municipal vehicle fleet
Projected GHG Reduction by 2009: 104 Tons eCO₂
Implementation year(s): 2005-2008

According to the GHG Emissions Inventory, the municipal vehicle fleet was driven 195,000 miles in 1997. Assuming a base average gas mileage of 20 mpg, improving the average gas mileage to 35 miles per gallon would result in an annual eCO₂ reduction of approximately 104 tons annually. This could be accomplished by replacing older vehicles with more efficient newer models including gas/electric hybrids such as the Toyota Prius and the Ford Escape hybrid SUV.

Town Green Fleet Strategy: Enforce State idling laws for municipal vehicles, equipment & school buses
Projected GHG Reduction by 2009: 20 Tons eCO₂
Implementation year(s): 2004

Every 10 minutes of idling wastes 0.026 gallons of gasoline.¹² In Massachusetts, state law¹³ and DEP regulations¹⁴ limit vehicle idling to no more than five minutes in most cases. A vehicle may idle longer only if absolutely necessary. There are exceptions for vehicles being serviced, vehicles making deliveries that need to keep their engines running (to power refrigerators, for example), and vehicles that need to run their engines to operate accessories (such as power lifts). The Department of Environmental Protection is also working to reduce emissions from buses, trucks and other heavy-duty vehicles by requiring them to undergo emissions testing every other year and by requiring new diesel engines sold in Massachusetts to meet stringent California emission standards in model year 2005 and beyond.

Strict enforcement of the State's idling laws for all town vehicles will reduce wear and tear on vehicles, improve air quality, reduce fuel costs, and reduce GHG emissions. Estimating a reduction of 5 minutes (from 10 to 5 minutes total) for town gasoline vehicles would annually save 1,103 gallons of gasoline, eliminate approximately 12 tons of eCO₂ annually, and save approximately \$2,536 in fuel costs. In diesel fleet vehicles the measure would save approximately 783 gallons of fuel, eliminate approximately 8 tons of eCO₂ annually, and save approximately \$1,802. Amherst's air quality would improve as a result of the measure: by 2009, the overall reduction in idling would reduce U.S. EPA recognized criteria air pollutants carbon monoxide (CO) by 834 pounds, nitrogen dioxide (NO_x) by 167 pounds, sulfur dioxide (SO_x) by 8 pounds, and particulate matter (PM) by 5 pounds.

¹¹ All fuel (gasoline, diesel, biodiesel) savings calculations use July 2005 average prices, as indicated. Source: <http://massachusettsgasprices.com>

¹² <http://www.hcdoes.org/airquality/vehicles/IdleFAQ.htm>

¹³ M.G.L. Chapter 90, Section 16A

¹⁴ 310 CMR 7.11(1)(b)

Town Green Fleet Strategy: Improve vehicle maintenance program
Projected GHG Reduction by 2009: 8 Tons eCO₂
Implementation year(s): 2006

According to the GHG Emissions Inventory, the baseline gasoline consumption in 1997 for the municipal fleet was 84,817 gallons. Improved scheduling and regularity of vehicle maintenance could produce a 5 percent reduction in fuel usage, saving 4,240.9 gallons. Baseline diesel consumption in 1997 for the municipal fleet and school buses was 60,276; a five percent reduction would save 3,013.8 gallons of diesel fuel. The combined savings would reduce eCO₂ production by approximately 8 tons annually, and save \$1,667 in fuel costs.

Town Strategy: Create a Town Employee Commuter Incentive Program
Projected GHG Reduction by 2009: 15 Tons eCO₂
Implementation year(s): 2006

Insight into the commuting habits and preferences of employees can inform the Town's implementation of measures that will simultaneously meet employee needs and reduce the overall contribution to transportation-related GHGs. This strategy proposes that the Town provide incentives to Town employees who find alternatives to single-occupancy vehicle commuting, such as carpooling, taking public transit, walking, or bicycling to work. A survey of Town employee commuting habits was conducted in the summer of 2004 and adjusted to the 1997 baseline of the GHG Emissions Inventory, which was conducted in 2001. A sample of 50 responses from the Town's 580 employees revealed an average daily commute by car of 17 miles round trip.¹⁵ A significant 54 percent of employees polled drive small/compact and mid-size vehicles (24 and 30 percent, respectively). Over 48 weeks per year (accounting for weekends and holidays), this equals 473,000 vehicle miles traveled (VMT) annually by Town employees. None of the respondents reported carpooling, which reflects the town-wide trend of a carpooling rate nearly half the national rate. If one eighth of Town employees (72 people) carpooled to work, VMT would be decreased to 443,000, saving approximately 15 tons of eCO₂ annually.

Town Strategy: Create work arrangements to allow Town employees to work at home
Projected GHG Reduction by 2009: 6 tons eCO₂
Implementation year(s): 2006

Assuming, as in the above measure, that 580 Town employees commute an average round trip of 17 miles for 48 weeks per year and the total VMT is 473,000 per year, the average yearly VMT is 816 per employee. This means that an employee working from home half-time saves approximately 408 VMT annually. Five percent of full time Town employees (29) working from home half-time would save 11,832 VMT and approximately six tons of eCO₂ annually.

Town Strategy: Priority/free parking for employees using Ultra Low Emissions Vehicles (ULEVs) to commute to work
Projected GHG Reduction by 2009: 3 Tons eCO₂
Implementation year(s): 2006-2009

Free or priority parking for ULEVs could encourage Town employees to consider purchasing these vehicles or otherwise reassess their commuting behavior. Additionally, a dedicated parking area for these vehicles would further the influence of the Town's Green Fleets resolution by demonstrating leadership among Town employees in supporting high-efficiency vehicles. This example to the community would serve to encourage residents and employers who are inclined to purchase such vehicles.

Using the employee commute data above, five percent of employees (29) switching to ULEVs for their work commutes would replace 23,664 VMT of regular, full-size vehicles with high-efficiency ULEVs, which would produce approximately three fewer tons of eCO₂ annually.

¹⁵ This survey was not able to collect responses from school employees

Town Strategy: Create a Town-wide Pedestrian and Bike-Friendly Environment
Projected GHG Reduction by 2009: 30 Tons eCO₂
Implementation year(s): 1997-2008

Amherst plans for future links to the Norwottuck Rail Trail include the design, layout, and future federal and local funding of several major connections to the business districts and educational institutions in town. Further discussion of the Town's Bikeway Planning can be found in the Land Use and Planning section. Other planned and recommended improvements entail:

- Expanding bike accommodations throughout the Town;
- Including painted lines and logos, in all street and road improvements;
- Posting appropriate signage for bicyclists at intersections and along roadways;
- Providing bike accommodations, such as racks and storage facilities, for residents commuting to work;
- Maintaining a network of pedestrian facilities throughout Town, including safe crossings, sidewalks or wide shoulders, traffic calming features; and
- Developing additional bike connectors.

The Amherst Conservation Department maintains over 80 miles of trails, approximately 25 miles of which could be used for non-recreation commuting. According to ICLEI, a town the size of Amherst would average approximately 20,000 annual bike trips, and the national commute averages 11 miles in length. Amherst residents, according to the 2000 Census, commute an average seven minutes less than the national average (18 minutes vs. 25 minutes,) and regional trail networks, such as the Norwottuck Rail Trail, link business and residential districts. Assuming that 25 percent of yearly bike trips were used for work and replaced car trips, VMT would be reduced by 55,000 yearly and eCO₂ would be reduced by approximately 30 tons.

Town Strategy: Increase Use of Public Transit
Projected GHG Reduction by 2009: 10 Tons eCO₂
Implementation year(s): 1997-2009

PVPC predicts Amherst will experience 350,477 VMT in 2009. Incentives could divert five percent of this total (17,524 VMT) onto mass transit, reducing 2009 VMT to 332,953 and saving approximately 10 tons of eCO₂. These incentives could include:

- Distribute information on the benefits of riding the bus;
- Support increased funding for public transit;
- Support development of an on-demand transportation system (i.e. vans, taxis, and car-sharing); and
- Partner with the colleges and UMASS Amherst to further a regional transportation plan.

Town Strategy: Increase Amherst Police Bike Patrols
Projected GHG Reduction by 2009: 5 Tons eCO₂
Implementation year(s): 1997

The Amherst Police Department (APD) has used police bike and foot patrols since 1997. Officers are assigned to bike patrol between April and November. In addition to the departmental benefits of enhanced duty performance, financial savings and a reduction in the emission of air pollutants and GHGs, the Department has found the bikes to be an excellent tool in community policing because of increased contact with the public.

The APD currently has nine patrol officers trained in bike patrol. While the actual fleet of cruisers was not reduced as a result of the bicycle patrols, this patrolling method extends the life and condition of the existing fleet, and will be considered for expansion as weather and staffing permits. A minimum number of cruiser patrols are required for each shift to respond to emergency calls. When staffing is above that minimum number, officers can be assigned to patrol on bikes and foot in lieu of cruiser patrol.

Bike patrol miles saved can be calculated as follows: 32 weeks of patrol at four shifts per week and 20 miles on the bike per shift equals roughly 2,770 miles. According to APD, there is typically at least one officer on bike patrol from 7AM to 3PM on four days out of each week during April through November (32 weeks). The current savings achieved by replacing one full-size patrol vehicle, averaging 20 miles per gallon, with one bicycle officer traveling 2,770 vehicle miles, represents a 143.5 gallon reduction, \$330 in fuel costs, and two tons of eCO₂. Increasing the current fleet of one bicycle officer to three would save an additional 287 gallons of gasoline, \$660 in fuel costs, and approximately three tons of eCO₂ annually.

Additionally, the Department's sport utility vehicle is used not for general patrol. It is reserved for Community Policing purposes and Critical Incident Response instances where the transport of equipment necessitates the larger vehicle.

INSTITUTIONAL TRANSPORTATION STRATEGIES

AMHERST COLLEGE

Amherst College Strategy: Modifications to Vehicle Pool and Program Equipment

Projected GHG Reduction by 2009: 46 Tons eCO₂

Implementation year(s): 1997

Amherst pool vans are driven about 100,000 miles each year. In 1997, the college began replacing traditional 12-passenger utility vans with seven-passenger minivans. Currently the college's van fleet is composed entirely of higher fuel efficiency minivans. The fleet mileage has been doubled from 12 miles per gallon (mpg) to over 24 mpg, saving 4,200 gallons of gasoline annually and approximately 46 tons of eCO₂ annually.¹⁶

Amherst College Strategy: Use Hybrid Vehicles in Vehicle Pool

Projected GHG Reduction by 2009: 3 Tons eCO₂

Implementation year(s): 2005

In 2005, Amherst College replaced two of its pool vans with hybrid vehicles that are more fuel efficient, with an average 40 miles per gallon, yearly savings of 300 gallons of gasoline, and an eCO₂ reduction of approximately 3 tons annually.

Amherst College Strategy: Convert Heavy Equipment from Gasoline to Diesel

Projected GHG Reduction by 2009: 16 Tons eCO₂

Implementation year(s): 1997

The College's maintenance vehicles, tractors, large trucks, and lawn mowers have all been converted to diesel from gasoline. This change has reduced fuel consumption of the maintenance fleet by 30 to 50 percent, saving 1,500 gallons of gasoline annually and approximately 16 tons of CO₂ annually. The College will also be implementing a no-idling policy to reduce emissions.

Amherst College Strategy: Biodiesel Conversion

Projected GHG Reduction by 2009: 11 Tons eCO₂

Implementation year(s): 2005

Starting in 2005, Amherst College is using bio-diesel for all its diesel equipment, reducing approximately 11 tons eCO₂ annually.

¹⁶ All Amherst College Energy Use and CO₂ reduction figures were provided by Aaron Hayden, Amherst College Capital Projects Manager and Campus Utilities Engineer and Task Force member

Amherst College Strategy: Zero Emission Vehicles (ZEVs) for Police Fleet
Projected GHG Reduction by 2009: 3 Tons eCO₂
Implementation year(s): 2009

The Campus Police are investigating the feasibility of substituting ZEVs for traditional police cruises. This can replace 25 percent of the gasoline-powered mile of the police patrols, save approximately 300 gallons of gasoline annually, and approximately three tons of eCO₂ annually.

Amherst College Strategy: Police Bicycle Patrol
Projected GHG Reduction by 2009: 1 Ton eCO₂
Implementation year(s): 1997

The Amherst College Police use bicycles for patrolling whenever possible and have reduced the cruise fleet mileage by about 1,000 miles, saving about 50 gallons of gasoline annually and approximately one ton of eCO₂ annually.

Amherst College Strategy: Carpooling
Projected GHG Reduction by 2009: Unknown
Implementation year(s): Unknown

Amherst College is working with the Route 9 Transportation Management Association (TMA) to encourage carpooling to reduce fuel consumed for commuting. Carpool organization is facilitated with an electronic bulleting board on the College website.

Amherst College Strategy: ZIPcar program
Projected GHG Reduction by 2009: Unknown
Implementation year(s): Unknown

The College is investigating the ZIP car program that rent vehicles by the hour to encourage members of the college community to leave their cars at home.

UNIVERSITY OF MASSACHUSETTS, AMHERST

UMASS Amherst Comprehensive Campus Transportation Study

In February 2002, UMASS Amherst, in partnership with the Pioneer Valley Transit Authority and IBI Group, released the UMASS Comprehensive Campus Transportation Study. This study evaluated all aspects of transportation internal and external to the campus. It proposed a number of recommendations, some of which have been adopted and are described below.

UMASS Amherst Strategy: UMASS Transportation Alternatives Program (TAP)
Total Projected GHG Reduction by 2009: 1,607 Tons
Implementation year(s): 1997 - 2009

UMASS Parking Services and Transit Services instituted the Transportation Alternatives Program (TAP) in 1999, encouraging a variety of alternatives to commuting in single-occupancy vehicles. Two such alternatives are discussed below, which will save a total of 1,607 tons of eCO₂ annually.

UMASS Amherst TAP Strategy: Rideshare Program
Projected GHG Reduction by 2009: 1,474 Tons eCO₂
Implementation year(s): 1997

The UMASS Rideshare Program provides an alternative to single-occupancy vehicles by assisting UMASS employees and off-campus students with the formation of carpools. The goals of the UMASS Rideshare Program are to reduce commuter traffic, improve the environment of the region and offer an economic alternative to full cost UMASS Parking permits. Rideshare services are offered free of charge to any employee or off-campus student on the Amherst campus. Services offered include carpool matching service, *Guaranteed Ride Home*, and commuter information on transit services and Park-and-Ride lots. According to the 2002 Rideshare Program update, there are approximately 18,000 commuting students and staff at UMASS. Of these, 60 percent drive alone, 18 percent travel by bus, nine percent carpool, four percent walk, three percent bicycle, and the remaining six percent use combined modes.

Currently, nine percent of 18,000 commuters (1,620) carpool. Increasing the number of commuting students carpooling by 11 percent would require getting 1,188 additional commuters to carpool. Assuming these commuters had previously been driving alone, this would reduce the number of single occupancy drivers to 9,612, or just under 50 percent of the commuting population. Assuming that vehicular travelers (93 percent or 16,740 of commuting students) have an average daily round trip commute of 30 miles, five days a week for 32 weeks a year equals approximately 4,800 yearly VMT per person. Total VMT for students commuting with vehicles (16,740) equals 80,352,000 yearly VMT total. This measure reduces the total VMT by 2,851,200, and eCO₂ by approximately 1,474 tons annually.¹⁷

UMASS Amherst TAP Strategy: Bicycle Commuter Program
Projected GHG Reduction by 2009: 133 Tons eCO₂
Implementation year(s): 1997-2007

The UMASS Bicycle Commuter Program is part of the UMASS Transportation Alternatives Program (TAP). UMASS works to promote bicycling as a healthy, environmentally friendly way of getting around campus and the surrounding towns. These efforts are an important part of the University's program to reduce dependence on single occupancy vehicle commuting and protect the environment. Three percent (540) of commuting students bicycled to UMASS in 2002. Increasing bicycle commuting by 25 percent (135 students) to 675 students would result in a 324,000 VMT reduction (assuming an average VMT per student of 2,400 to account for those switching from mass transit and carpooling, as well as single occupancy vehicles) and save approximately 133 tons of eCO₂ annually.

UMASS Amherst Strategy: Substitute Biodiesel for Oil-Based Diesel
Projected GHG Reduction by 2009: 117 Tons eCO₂
Implementation year(s): 2005

Current consumption of diesel fuel for the UMASS vehicle fleet is approximately 53,000 gallons annually. Assuming that usage levels remain relatively constant, converting to bio-diesel would save approximately 117 tons of eCO₂ annually.

**The Commuter Choice
Leadership "Best Workplace
for Commuters" Award**

The Environmental Protection Agency (EPA) recognized UMASS in 2003 for their efforts in reducing single occupancy vehicles commuting to campus. The Commuter Choice Leadership "Best Workplace for Commuters" designation recognizes employers who are working to reduce traffic congestion and traffic-related air pollution. UMASS Amherst is one of 300 national employers who have been recognized by the Commuter Choice Leadership Program.

¹⁷ Transportation energy use data provided by John Pepi at UMass Amherst

UMASS Amherst Strategy: Improved Vehicle Maintenance Program
Projected GHG Reduction by 2009: 96 Tons eCO₂
Implementation year(s): 2006

Provide ongoing training & education to improve vehicle maintenance. With current gasoline use for the UMASS vehicle fleet at approximately 179,000 gallons/year, a five percent improvement in efficiency resulting from maintenance and operator training/education will save 8,950 gallons of gasoline, resulting in an eCO₂ savings of approximately 96 tons annually.

UMASS Amherst Strategy: Purchase Alternative Fuel (AFV) Vehicles
Projected GHG Reduction by 2009: 7 Tons eCO₂
Implementation year(s): 2006

UMASS plans to integrate AFVs into the campus fleet. The following purchases are under consideration and would lower campus GHG production by seven tons annually.

- Toyota Prius hybrid – one ton eCO₂
- Purchase 6 neighborhood electric vehicles (NEVs) – three tons eCO₂
- 3 Electric pickup trucks or minivans – three tons eCO₂

Current gasoline use is approximately 179,000 gallons/year. If the above new vehicles replaced existing older, comparably-sized gasoline-powered vehicles in the fleet, total eCO₂ savings of approximately seven tons would be realized annually.

OTHER TRANSPORTATION STRATEGIES

Other Strategy: Route 9 Transportation Management Association
Projected GHG Reduction by 2009: Unknown
Implementation year(s): 1999

The Route 9 Transportation Management Association (TMA) is a public/private partnership that works together to address important transportation issues along the Route 9 Corridor in the Pioneer Valley. The members are dedicated to providing a variety of commuter options for their employees, customers and the community. These commuter options include carpools, vanpools, public transportation, bicycling, walking, and telecommuting. The goal of the Route 9 TMA is to reduce traffic congestion and improve the air quality of the region.

Led by the University of Massachusetts Amherst, several large employers along the Route 9 Corridor area have met on an informal basis to discuss common transportation issues. Discussions led to the decision to form a Transportation Management Association (TMA) to focus comprehensively on the transportation issues facing the Pioneer Valley. UMASS, Cooley Dickinson Hospital, and the City of Northampton have signed a memorandum of understanding including a mission statement and an outline of actions that will guide the Route 9 TMA's future direction. Representatives of Amherst College, the Town of Hadley, the U.S. Fish & Wildlife Service, the Pioneer Valley Planning Commission, and the Amherst Chamber of Commerce also participated in the TMA formation committee. It is envisioned that the Route 9 TMA will grow into an organization which promotes accessibility options and addresses transportation issues for employers and commuters well into the future.

Other Strategy: The Pioneer Valley Community Transit Enhancement Project
Projected GHG Reduction by 2009: Unknown
Implementation year(s): 2001

The Pioneer Valley Transit Authority (PVTA) and Pioneer Valley Planning Commission (PVPC) are working to improve community livability and air quality through programs like the Community Transit Enhancement Project 2001. The focus of this project was to respond directly to community-initiated projects to add and improve transit

stop amenities and strengthen connections between transit stops and the surrounding neighborhoods. By making transit and transit stops a vibrant focal point of each community, more people will be encouraged to take the bus.

Three community-initiated projects were selected through a competitive process to make physical improvements to transit stops. These included construction of shelters and benches, improvement of pedestrian, bicycle, and parking amenities at transit stops, and assistance to communities in adopting transit-friendly changes to local zoning ordinances. The goals of this project are to strengthen communities and increase transit ridership. The project will give communities the tools to enhance the appearance of neighborhoods and improve the experience of riding the bus while preserving and revitalizing the traditional urban or town center form.

Other Strategy: Safe Routes to School Program
Projected GHG Reduction by 2009: 6 Tons eCO₂
Implementation year(s): 2006

The Federal Highway Administration has reported that roughly half of all 5 to 18- year olds either walked or biked to school in 1969. The journey to school has changed dramatically in recent years. By 2001, nearly nine out of ten children between the ages of 5 and 15 were driven to school by either a parent or a bus driver. This increase adds a significant amount of additional traffic to the morning commute and congestion to communities around schools.



The reasons for this decline in walking and biking trips to school are multifold. For one, the journey between home and school has become longer and more treacherous because of decades of auto-oriented suburbanization. Accentuating the negative impact of this development pattern has been a trend away from neighborhood schools to large, consolidated schools. This has been fostered by national and state school guidelines recommending minimum school lot sizes that often can only be found on the edges of urban and even suburban areas. Fears and concerns exist among parents about exposing their children to threats from strangers and motor vehicles. Finally, sidewalks, crosswalks, bike lanes, and trails are either missing or inadequate in many suburban and rural communities.

Safe Routes to School is a nationwide movement spurred on by the U.S. Department of Transportation's 1994 National Bicycling and Walking Study and the Center for Disease Control's 2001 goal to increase youth walking and biking to school by 67 and 100 percent, respectively. In 2001, Boston adopted the Safe Routes to School Program and WalkBoston, a non-profit pedestrian advocacy organization, launched New England's first Safe Routes to Schools (SRS) demonstration project. Begun as a walk-to-school initiative in two elementary schools and the middle school in Arlington, WalkBoston's program has now expanded to include select schools in Milton, Dedham, and East Boston. All of the participating programs are in communities of moderate density with neighborhood schools and interconnected streets where it is possible to walk to school.

A Safe Routes to School program in Amherst could produce an eCO₂ reduction of up to six tons by 2009. Assuming there are approximately 100 walkable school days per year because of weather and other issues, a family within a one mile radius of an Amherst school would net a yearly reduction of approximately 100 VMT. With the participation of one hundred families, a yearly reduction of 10,000 VMT could be achieved, which would translate into approximately 6 tons of eCO₂ annually.

TOTAL ESTIMATED GHG REDUCTION FOR TRANSPORTATION = 2,247 TONS

C. Waste Management

THE ROLE OF WASTE IN AMHERST'S GHG EMISSIONS

There are two main impacts on climate change from the generation of solid waste, one direct and one indirect. The direct impact is due to the anaerobic decomposition of organic waste, which produces the greenhouse gas methane. Businesses that produce significant amounts of organic waste, such as food and paper waste, can help reduce this by composting (in the case of food waste) and simple waste reduction measures such as printing double-sided copies. The indirect link to climate change has to do with embodied energy, which is the energy needed to produce the raw materials required to manufacture a product. By recycling and purchasing products with high recycled content, a business can cut down on this embodied energy. According to the Massachusetts Department of Environmental Protection, Amherst recycled 44 percent of its waste in 2003, the latest year for which data were available.¹⁸

AMHERST'S SOLID WASTE COMMITTEE

Formed in 1987 by Town Meeting vote, the Amherst Solid Waste Committee is charged with continuing the development of a comprehensive, long-term solid waste plan that:

- Emphasizes source separation and recycling and full use of any regional recycling facility;
- Promotes regionalization of solid waste policy;
- Expands town recycling programs to include apartments and complexes;
- Investigates cooperative efforts that lead to recycling of solid waste from UMASS, commercial firms, and other town institutions;
- Initiates a town-wide compost program including private, commercial, and municipal organic debris;
- Evaluates and takes advantage of state and federal programs that foster recycling, composting, and waste reduction;
- Provides adequate and timely publicity, consultation, and general education to those affected when designing or implementing new programs; and
- Coordinates the introduction of a conservation curriculum with the Amherst School System.

Many of the Town strategies identified below largely come from Amherst's Solid Waste Committee.

TOWN WASTE MANAGEMENT STRATEGIES

Town Strategy: Support Responsible Manufacturing and Disposal of Products, Such as "Producer Take-Back" Campaigns

Projected GHG Reduction by 2009: 9 Tons eCO₂

Implementation year(s): 2006

The Town's Select Board and Solid Waste Committee have registered their support in the past for Producer Take-Back Campaigns, and they will continue to urge the legislature to support a "Computer Take-Back Bill." Amherst financially supports over a dozen recycling programs, and the recycling of electronics has become one of the Town's largest and most expensive programs. In 2003, for example, Amherst citizens brought over fifteen tons of electronics to the Town Recycling Center. This amount does not include all the electronics that are collected at the public schools, the colleges and university, or at private companies in the area. At fifteen cents per pound, plus seventy dollars per pickup to send electronics to a Department of Environmental Protection-approved recycling facility, recycled electronics demand a great deal of municipal support, both financially and in employee hours.

¹⁸ <http://www.mass.gov/dep/recycle/files/munirate.doc>

A less expensive and more direct method would be for the computer companies or the retail stores to shoulder the responsibility for the reuse/recycling of computers and other electronics. The Dell Computer Company, for example, runs a successful “take-back” campaign in several large cities around the country. Take-Back campaigns for high volume materials such as bedding and carpeting could also have a large impact on the amount of landfilled waste.

At Amherst’s Earth Day 2004 Celebration, 130 air conditioners were collected for de-commissioning through an air conditioner Turn-In event. Residents who turned in a functioning, inefficient window unit received a \$50 rebate to purchase a new ENERGY STAR®-rated window unit from a local appliance dealer. Useful parts from the old units are recycled, and any unusable components are disposed of responsibly. Reducing the use of inefficient air conditioners goes a long way in reducing energy consumption, conserving natural resources, and protecting the environment. According to Western Massachusetts Electric (WMECO), at 2003 turn-in events, WMECO customers across the region retired, recycled, and replaced over 1,600 air conditioner units with new ENERGY STAR-qualified models. As a result, they reduced greenhouse gas emissions by over 3,200 tons over the lifetime of the equipment, the equivalent of removing over 430 automobiles from the road annually. ICLEI estimates an approximate savings of three tons of CO₂ per ton of appliances like computers and air conditioners recycled. This measure assumes the removal of 3 tons from waste stream, producing an eCO₂ savings of approximately nine tons annually.

Town Strategy: Landfill Methane Recapture
Projected GHG Reduction by 2009: 21,267 Tons eCO₂
Implementation year(s): 2009

The unmanaged decomposition of organic material in landfills releases methane, a powerful GHG twenty times more potent than CO₂. The release of methane is a major component of global climate change. Capturing the methane and burning it off helps prevent buildup of greenhouse gases at landfills. According to the EPA, approximately 380 landfill gas (LFG) energy projects were operational in the United States at the end of 2004. These 380 projects generate approximately nine billion kilowatt-hours of electricity per year and deliver 200 million cubic feet per day of LFG to direct-use applications. The EPA estimates that more than 600 other landfills present attractive opportunities for project development.

The Amherst landfill on Belchertown Road has been identified by the EPA as a good candidate for methane recovery operations. The landfill, which was opened in 1982 and closed in 2003, holds approximately 525,096 tons of waste according to the EPA.¹⁹ According to ICLEI, 75 percent is an average-to-conservative recovery rate for projecting GHG savings resulting from this type of measure. This measure, if implemented in the beginning of 2009, would save 21,267 tons of eCO₂. For a number of reasons, including low production and difficulties with neighborhood approvals, this does not seem feasible at this time, but should be revisited periodically.

Town Strategy: Rain Barrel Offer
Projected GHG Reduction by 2009: Unknown
Implementation year(s): 2003

Amherst has partnered with The New England Rain Barrel Company to promote water conservation by offering customized rain barrels at a greatly reduced rate to all citizens of the Amherst area. Sixty-one barrels were sold between January 2003 and March 2005. Each of these barrels, which are made from recycled plastic, holds 55 gallons of pure rainwater collected from the roof of the owner's home. For Earth Day 2004, the New England Rain Barrel was offered for sale at \$62, a \$23 savings off the regular price of \$85. Residential irrigation can account for 40 percent of domestic water consumption in a given municipality. Rain barrels can help to decrease demand during the sweltering summer months.

¹⁹ Source: EPA database, <<http://www.epa.gov/lmop/proj/index.htm>>

Collection of water from rooftop runoff can provide an ample supply of free “soft water” containing no chlorine, lime or calcium, making it ideal for landscape irrigation, watering indoor plants, automobile washing and cleaning household windows. Saving water in this manner benefits the community by reducing demand for treated tap water and individual households by lowering monthly water bills. Rainwater diversion also helps decrease the burden on water treatment facilities and municipal drainage systems during storms.

Town Strategy: Extend “Buy Recycled” Policy
Projected GHG Reduction by 2009: Unknown
Implementation year(s): 2006

Amherst Town government adopted a “Buy Recycled” policy in 1988 for the public schools, the colleges, area businesses, and the Chamber of Commerce. The Town not only saves money by buying recycled products, it reduces GHGs while obtaining quality products. The cost to the environment of using virgin materials instead of recycled ones for new products is significant; for example, minimizing the number of trees deforested to create paper lowers GHG emissions. Institutions and businesses that use large quantities of recycled paper can be particularly good models for others. Publications listing many types of recycled products are available, such as the “Recycled and Environmentally Preferable Products and Services Guide,” published by the Operational Services Division of Massachusetts. Short-term goals include assessing the level of recycled product purchasing amongst the major consumers, schools, and businesses, and devising ways to encourage its expansion. It is expected that paper products will constitute the bulk of these.

Town Strategy: Convert To Aqueous-Based Parts Cleaners
Projected GHG Reduction by 2009: Unknown
Implementation year(s): 2006

By switching from solvent to aqueous-based parts cleaners for Town vehicles, the Town can eliminate associated hazardous wastes and reduce costs. For example, a vehicle maintenance facility in Hartford eliminated the use of solvents by switching to two aqueous-based sink-over-drum units. By eliminating solvent wastes, the environmental, health and safety hazards are reduced.

INSTITUTIONAL WASTE MANAGEMENT STRATEGIES

FIVE COLLEGES

Five Colleges, Inc. has a Recycling Manager who develops and implements, promotes, and monitors the waste management and recycling programs at Amherst College, Hampshire College, Mount Holyoke College and Smith College campuses. The Manager provides advice and research support for cooperative waste management, recycling and composting activities at each college; recycling coordination at UMASS Amherst is managed by University staff.

AMHERST COLLEGE

Amherst College Strategy: Universal Waste Management Program Projected GHG Reduction by 2009: Unknown Implementation year(s): 1997-2007

In an effort to better manage universal waste, Amherst College has developed and implemented a Universal Waste Management Program. Universal waste, which include fluorescent light tubes, sodium vapor lamps, batteries, and computer/television monitors are regulated by the federal and state environmental agencies and are no longer disposed of in the regular waste stream. They are separated from landfill wastes by Amherst College employees and processed separately; the College recycled 143 tons of universal waste in 2004.

The Amherst College Universal Waste Management Program ultimately applies to each and every person on campus. However, control of the program and the proper handling of the Universal Wastes is primarily the responsibility of the Physical Plant Custodial and Special Service departments. These branches of the Physical Plant identify, package, and relocate universal waste to a central receiving area where the material is either later picked up by an outside vendor or relocated to another location (University of Massachusetts Intermediate Processing Facility) for recycling or reclamation.

Amherst College Strategy: Recycling Program Projected GHG Reduction by 2009: 435 Tons eCO₂ Implementation year(s): 1997-2007

Amherst College actively promotes recycling on campus for basic recyclables including: bottles, cans, cardboard, paper and scrap metal. The recycling rate for basic recyclables has increased from about 25 percent to approximately 38 percent of the total waste stream. According to Aaron Hayden at Amherst College, in 2004 the College recycled 114 more tons of mix recyclables annually than it did in 1996, which will result in an eCO₂ savings of approximately 435 tons annually.

The College has created a recycling coordinator position to organize the recycling effort. The position addresses the promotion of the recycling program to increase environmental awareness. These efforts along with the wide distribution of containers on campus have helped to increase the amount of material recycled on campus. In order to promote and encourage routine recycling in the long term, all new and renovated buildings incorporate recycling closets on every floor and a central collection point with good access to the curbside, in each building. Recycling rates increase when efficient recycling program is “built in” to the campus.

Amherst College “deconstructs” buildings rather than simply demolishing them. This deconstruction allows most of the construction debris to be recycled and in 2004 the College recycled 7,590 tons. Amherst College is exploring ways to recycle post consumer food waste for composting.



RACE-TO-RECYCLE AWARDS

Recycling excellence at Amherst and Hampshire colleges was recognized with a state award in April, 2004. WasteCap of Massachusetts presented the 2003 Race-to-Recycle Awards to the two colleges. Harvard University won first place in the institution category, with Hampshire College in second place and Amherst College placing third statewide. The average recycling rate among award winners was 41%, which was Harvard's achievement. Hampshire recycles 45.9% and Amherst 47% but missed first place because their size is dwarfed by Harvard's volume.

HAMPSHIRE COLLEGE

Hampshire College Strategy: Waste Management Program

Projected GHG Reduction by 2009: 61 Tons eCO₂

Implementation year(s): 1997-2007

The mission of Hampshire College's waste management program is to use processes, practices, materials, or products that avoid or reduce pollution, which may include process changes, efficient use of resources, material substitution and recycling. The college challenges and empowers each employee and student to promote environmental leadership through an environmental principle, "Ride the CREST:" C: Continuous Improvement; R: Reduce, Reuse, Recycle; E: Environmental Compliance; S: Stewardship; and T: Training and Education.

According to Hampshire College, in 1997 total waste was 550.5 tons and total recycling was 235.4 tons, or 43 percent. By 2004, total trash was 632 tons and 292.2 tons recycled, or 47 percent. Assuming recycling continues to increase at relatively the same rate, 16 tons waste will be affected, resulting in an eCO₂ savings of approximately 61 tons annually.

UNIVERSITY OF MASSACHUSETTS, AMHERST

UMASS Amherst Strategy: Waste Management Program

Projected GHG Reduction by 2009: 7,367 Tons eCO₂

Implementation year(s): 1997-2007

It is the mission of UMASS's Office of Waste Management (OWM) to provide for the timely and efficient removal of any and all solid waste generated at the University and to process and dispose of these wastes in a manner that is the least harmful to the natural environment, the University community, and the public. The OWM subscribes to the concept of Integrated Solid Waste Management (ISWM), which holds that "garbage" is not a homogenous mass to be burned or buried and then forgotten. Instead, "garbage" consists of a heterogeneous spectrum of discarded materials and products each with specific characteristics and properties which make them more or less suitable for reuse, recycling, composting, or disposal. ISWM asserts that the environment endures the least harm and receives the most benefit when garbage is managed according to the following waste management hierarchy:

- Reduce
- Reuse
- Recycle or Compost
- Incinerate with Energy Recovery
- Landfill

The University is now closing in on the OWM goal of consistently recycling or composting 60 percent of the campus waste stream. In addition, the OWM is constantly seeking opportunities to expand the quantity of "green" or recycled content products purchased by the University. According to the GHG Emissions Inventory, UMASS Amherst total waste in 1997 was 6,439 tons, 44 percent of which was recycled (2,815 tons). Increasing recycling by two percent per year will affect 1,932 tons waste, for an eCO₂ savings of approximately 7,367 tons annually.

OTHER WASTE MANAGEMENT STRATEGIES

Other Strategy: Amherst's Composting Program Projected GHG Reduction by 2009: 271 Tons eCO₂ Implementation year(s): 1997-2007

Composting food waste, rather than landfilling it, results in a net reduction of greenhouse gases. Composting in backyards or in central facilities such as programs at Smith Vocational School or UMASS Tillson Farms does not produce methane in the same quantity as landfills. Since 1995, the Town of Amherst has been selling compost bins at a reduced rate. As of the end of Fiscal Year 2004, over 2,000 composters had been sold. Calculations based on data from the Commonwealth of Massachusetts Residential Organic Waste Management Study²⁰ suggest that about 680 tons of food waste is diverted from the landfill per year.

According to the Center for Ecological Technologies, 16 to 18 restaurants in Amherst separated food wastes in 2003, diverting over five tons of waste per week from the landfill.²¹ This food waste is taken to Smith Vocational School or Martins Farms in Greenfield, where it is composted. UMASS and Hampshire College also divert food waste and produce quality compost. The goal for this initiative is to expand the program to the local schools and more restaurants in Amherst. Composting food waste saves money in hauler fees and significantly reduces the waste stream, while producing a quality, garden-enhancing product.

The restaurants participating in 2003 composted 8,386 tons per week in food waste, non-recyclable paper and waxed cardboard. The projected annual total was 218 tons of waste composted, or approximately 13.5 tons per restaurant. Five Northampton schools (2,055 students in four elementary and one middle school) participated and composted 2,040 lbs per week, or a projected 40 tons per year. A proposed expansion of the program assumes increasing restaurant participation by 25 percent to 20 restaurants (approximately 273 tons annually) and the participation of Amherst schools at a similar level as the Northampton schools (approximately 40 tons annually). These combined efforts would remove 312 tons of material from the waste stream and eventual landfilling, saving approximately 271 tons of eCO₂ annually.

Other Strategy: The Wildwood Green Team Projected GHG Reduction by 2009: Unknown Implementation year(s): 2003

Wildwood School's Green Team consists of five mothers working towards strategies that both educate children and protect the environment. Their work has involved the composting program in school lunchrooms and campaigning for the schools to purchase recycled paper. They are currently working to reduce school bus idling in front of schools at drop-off and pick-up. They are looking into grants to reduce diesel emissions, extended exposure to which has been linked to asthma and lung cancer.

TOTAL ESTIMATED GHG REDUCTION FOR WASTE MANAGEMENT = 29,410 TONS

²⁰ October 1999. <http://www.mass.gov/dep/recycle/files/repfinal.doc>

²¹ CET 2003 Composting in Restaurants and Schools Municipal Toolkit, <http://www.cetonline.org/Publications/res-schools-online.pdf>

D. Land Use and Planning

THE ROLE OF LAND USE AND PLANNING IN AMHERST'S GHG EMISSIONS

Massachusetts is known around the world for its pedestrian-friendly cities, aesthetically attractive, historic downtowns and quaint New England villages. These vital community centers are characterized by dense settlement, narrow streets, public parks and mixed uses that allow citizens to live within easy walking distance of shops, restaurants, commercial services and places of work. These communities have typically blended well with a healthy, natural environment and have provided a high quality of life.

However, recent growth trends in Massachusetts have steered away from this village center concept and spread development diffusely across the landscape. From 1950 to 1990, the Commonwealth's population grew by 28 percent, while the amount of developed land grew by 188 percent. Recognizing the importance of protecting the unique character of Massachusetts as the Commonwealth continues to evolve, the Executive Office of Environmental Affairs launched the Community Preservation Initiative in January 1999. Community Preservation is dedicated to providing tools and programs to help local leaders and residents make information decisions about growth and development.

GETTING IT ALL TOGETHER IN A MASTER PLAN

The Comprehensive Planning Committee (CPC) has recently undertaken the first step in creating a comprehensive Master Plan for the Town of Amherst. The CPC is made up of representatives of many of the Town Boards and Committees (Conservation Commission, Planning Board, Public Transportation, Fair Housing Partnership, Leisure Services and Supplemental Education, Chamber of Commerce, Finance Committee, School Committee, Historical Commission, Council on Aging, Library Trustees), liaisons from each of the institutions of higher education (UMASS Amherst, Amherst and Hampshire Colleges) and other at-large members from the community. The CPC has initiated an effort entitled "Planning Amherst Together," which is an inclusive and open public participation process to engage the full community of Amherst in an effort to 'Plan the Plan'.

The CPC has done an extensive outreach effort to hear from the community what it wants in a Master Plan and how it should go about creating one. It has become clear that residents value the quality of life in Amherst and want to preserve the environmental and cultural resources that are essential to the character of Amherst. While Amherst has done many innovative planning exercises through the years, the Town has not adopted a Master Plan since 1969. One impetus for undertaking a comprehensive master planning process is to bring all of the disparate planning efforts together, find the gaps and fill them, and create one coherent plan for the Town that will help guide decision-makers into the future. It is clear that a Master Plan for the Town of Amherst will include all of the strategies listed below, along with many others that will help to preserve the high quality of life while contributing to the Town's goal of reducing greenhouse gas emissions.

GOVERNOR'S SMART GROWTH LEADERSHIP AWARD

In 2004, The Town of Amherst was one of ten communities in the state recognized for exceptional planning and conservation efforts. Governor Mitt Romney presented the Town Conservation Department with the Governor's Smart Growth Award. In the category of Farmland Protection and Agricultural Viability, the Town has led the way in furthering farmland protection and supporting local agriculture through a comprehensive strategy of smart conservation and smart growth.

TOWN LAND USE AND PLANNING STRATEGIES

Town Strategy: Open Space Planning Process

Projected GHG Reduction by 2009: Unknown

Implementation year(s): Ongoing

The Town's Conservation Department is responsible for the administration of environmental laws and policies, open space protection and management, water management, preservation of natural features of the environment, and coordination for joint action with many town bodies. It assists the Conservation Commission in administering State and Town Wetlands Protection statutes; carries out a forest management program on 2,500 acres of Town watershed land in Shutesbury, Pelham, Belchertown, and Amherst; coordinates the Town Energy Conservation Task Force and GHG reduction program; administers the Town Community Garden program; oversees operations of the Cherry Hill Golf Course; and provides staffing for the Conservation Commission, Farm Committee, Public Shade Tree Advisory Committee, Amherst Area Trails Committee, and Cherry Hill Advisory Committee.

The Town prepares an updated, town-wide Open Space and Recreation Plan approximately every five years. The plan serves as a guide for future land protection, land management, and general conservation plans for the Town. The current Open Space and Recreation Plan, anticipated for release in the fall of 2005, emphasizes the following energy-related principles:

- Protected open space and farmland helps the Town direct growth toward developed centers and reduces the need for continued expansion of expensive systems of public utilities and services.
- The availability of public open space makes it more likely that residents will participate in outdoor recreation locally rather than driving out of the area for such activities. The Town currently has more than 1,966 acres of conservation land, including more than 40 open fields, in more than 50 discrete complexes, augmented by State land of the Holyoke Range State Park, Town recreation land, and de facto open space held by the University and the two colleges.
- A good supply of protected farmland will enable present and future generations to grow more food for the local market, helping to minimize the amount of food trucked in from out-of-state. The Town has worked with the Commonwealth to protect 33 properties by Agricultural Preservation Restriction (APR) totaling 2,000 acres. An additional 157 acres are covered by Conservation Restrictions, and the Conservation Department carries out additional land acquisition and protection projects for the Town with assistance from the Kestrel Trust, Valley Land Fund, and state and federal grants.
- The availability of a diverse, comprehensive pedestrian and bicycle trail network will allow people to commute and engage in recreational travel to local locations without relying as heavily on automobiles. The Town maintains some 80 miles of foot trails, including the multi-town Robert Frost Trail; is developing plans to expand that network with trail links to various residential neighborhoods; has worked with the Commonwealth to create the Norwottuck Rail Trail, its 1.5-mile southern extension and a 1.7-mile UMASS Connector to the Rail Trail; and is working with the University and Congressman John Olver on plans for further bikeway extensions and connections with regional trails.
- The enhancement of a wide range of outdoor recreation possibilities, including hiking, cross-country skiing, bicycling, horseback riding, nature study, and others.
- The additional protection of trails and greenways within town and linking Amherst to adjacent towns.

Town Strategy: Bikeway Connections
Projected GHG Reduction by 2009: Unknown
Implementation year(s): Ongoing

The Town will be continuing to work with the University of Massachusetts, the Pioneer Valley Planning Commission (PVPC), and Congressman John Olver to expand the system of bikeways linking Amherst with adjacent towns and counties for both bicycle commuting and recreational bicycling. The Norwottuck Rail Trail was opened in 1993 and lengthened to 10 miles a few years later with the addition of a southeastern extension from Station Road in Amherst to Warren Wright Road in Belchertown. In 2002, the Amherst-UMASS Connector linking the Norwottuck Rail Trail with the University of Massachusetts campus was opened for use.

Amherst plans for future links to the Rail Trail include the design, layout, and future federal and local funding of the following routes:

- A northern connection from UMASS to North Amherst via the “Cinder Road,” Brandywine Apartments, and Meadow Street. That connection would allow later extensions into Franklin County both northwest into Sunderland and north to Montague and Greenfield.
- A southern connection from the Hampshire College area over the Holyoke Range to South Hadley, possibly by way of the old trolley bed located east of Route 116.

PVPC and towns and cities along the Connecticut River corridor are also proceeding with plans to provide continuous bicycle routes from Springfield to Northampton and from Northampton west toward Williamsburg and beyond. Ideally, the expanded system of bike paths will greatly encourage bicycle commuting and recreational cycling throughout the Valley, and will provide additional connections among the Five Colleges.

Town Strategy: Progressive Zoning Regulations
Projected GHG Reduction by 2009: Unknown
Implementation year(s): Ongoing

The Town of Amherst has long had a national reputation for innovative planning and approaches to land use regulation. The Zoning Bylaw contains many provisions that promote more sustainable development practices including flexible clustered development, the protection of open space, the provision of affordable housing and alternative transportation opportunities. The primary purpose of the Zoning Bylaw is the promotion of the health, safety, convenience, and general welfare of the inhabitants of the Town of Amherst. In its broadest interpretation, this purpose most certainly includes efforts to conserve energy and protect the environment.

The Zoning Bylaw includes several techniques from overlay districts designed to protect certain resources to specific sections addressing site design issues. The overlay districts include the following: Aquifer Recharge Protection; Watershed Protection; Planned Unit Residential Development; and Farmland Conservation. For example, the Farmland Conservation District is configured to include, and intended to protect those lands which, by virtue of their soils, acreage, location adjacent to and contiguous with other farmland, and lack of protection under existing underlying zoning, comprise the critical farmland of the Town of Amherst. In this district, all subdivisions are mandated to be clustered and designed to keep large contiguous tracts intact for open space or farming. Amherst is also one of the first communities in Massachusetts to make cluster development of subdivisions the by right development (Site Plan Review vs. Special Permit) as opposed to traditional subdivision development methods.

Amherst’s Zoning Bylaw also includes zones to promote mixed use and compact village center development (Village Center Business, and Village Center Residence). These zones are intended to promote higher density mixed use in keeping with the traditional idea of New England Village Centers. Recently the Planning Department also received a grant from the U.S. Environmental Protection Agency, under their Livable Communities Program, and created a “Workbook for Sustainable Design Options: The Atkins Corner Plan.” This

document provides a master plan for the development of this village center using sustainable development principals that include; compact mixed uses, pedestrian and transit friendly design, solar orientation, bio-swales for stormwater treatment, and other climate-friendly, low-impact development techniques. Part of this project was also the development of a critique of our current zoning and recommendations for making zoning changes that would promote more sustainable development.

In general, Amherst's Zoning Bylaw has provisions to allow the Town to impose conditions and modifications of plans to minimize traffic impacts, minimize impacts on our infrastructure like water, sewer, etc. and minimize environmental degradation. The Zoning Bylaw also has specific design requirements that serve this purpose. For example, in Article 7, Parking and Access Regulations, Section 7.004 the parking requirements for commercial and business projects are structured to avoid the development of huge parking lots simply based on the square footage of the proposed buildings. After a certain square foot threshold, the requirements are reduced. There are also landscape standards (Section 7.11) that require landscape islands and shade trees in parking lots of over 10 spaces. Section 7.2 allows for shared/leased parking arrangements to encourage business not to build new parking lots if they can work out an arrangement with neighbors who have different peak use times. Section 7.8 requires the installation of bicycle racks/storage to encourage alternative transportation modes.

The section of the Zoning Bylaw that is most explicitly geared toward the encouragement of sustainable development and discouragement of bad development is Article 14, Phased Growth. All new residential development is subject to a development schedule that restricts the number of building permits allowed in any given year. The development schedule can be modified based on a point system that rewards good development and penalizes bad development. A developer can develop more units per year if they get positive points, but will be able to build less per year if they receive negative points. Positive points can be gained if the development provides any of the following: village center & mixed-use development; protects open space; preserves farmland; uses cluster; or is developed using a Planned Unit Residential Development (PURD) or Open Space Community Development (OSCD) method. Negative points are assigned for the following: development of prime farmland; development within the Aquifer and Watershed Protection areas (more without public sewer, less with public sewer). The Planning Board can also assign discretionary points for a number of things including: good site design which maximizes energy efficiency; responds to or protects natural features, reduces the cost of public services, including transportation; provides walking or bicycle paths; or is within 1,000 feet of a heavily traveled major arterial street.

Town Strategy: Active Living By Design Initiative
Projected GHG Reduction by 2009: Unknown
Implementation year(s): Ongoing

The Town, through the Planning Department, has recently begun work on developing an Active Living By Design Project. The goal of the Active Living By Design project is to create a highly visible, easily accessible, network of ways for people to move about the Town for work or leisure. This will take advantage of the transportation, open space and recreational resources available to promote a healthy and active lifestyle. The project will utilize the partnership of the Town, Colleges, and University to develop a comprehensive and detailed inventory of existing resources, an analysis of how these resources can be further developed and coordinated to create an integrated network, and a public education and outreach program designed to engage the community in utilizing the network.

It is hoped that the long-term impact will be a much more vibrant community. That the creation of a highly visible and accessible network of ways to get around to open space and recreational resources will be such a central part of the community that it will be one of the reasons many people choose to live here. That the many students that come to college here will be immersed in this lifestyle and hopefully carry on learned habits for the rest of their lives, and that the lives of all residents of the community will be enriched.

The Town has already developed many facilities and programs to promote Active Living. This includes a partially no-fee public transit system; the Rack & Roll program (bike carriers on the buses and bike racks/storage facilities around town); policies for accommodating bicycles on our roadways; six miles of off-road paved bike

trails; Downtown Way-finding System; Disabilities Access Plan; 50 miles of hiking trails, and many recreational facilities. The Town has a large and active Leisure Services and Supplemental Education department that provides many programs to all sectors of our population. The Town has a national reputation for innovative planning practices and strategies that seek to create a more sustainable and healthy environment as well as a legacy of protecting open space (30 percent of the town's land area is protected open space).

In the spring of 2004, the Town received a grant from a joint American Planning Association (APA) and National Association of County & City Health Officials (NACCHO) to send our Directors of Planning and Health to a Land Use Planning and Public Health Workshop in Washington, D.C. The Town has recently joined the Active Living Ambassador Project sponsored by the International City/County Management Association as a way to help us toward our goals of becoming a model Active Living By Design Community.

Town Strategy: Community Preservation Initiative
Projected GHG Reduction by 2009: Unknown
Implementation year(s): Ongoing

Amherst is an active participant in the Community Preservation Initiative. The Town realizes that unplanned growth results in a decentralized and incoherent pattern of development, often referred to as "sprawl," that consumes large amounts of open space and farmland, overburdens existing infrastructure, exacerbates municipal tight budgets and resources, and damages our environment.

Furthermore, sprawl jeopardizes our long-term economic well-being by squandering natural resources needed to support economic development, while increasing the cost of infrastructure and community services. As housing tracts and strip malls replace open spaces and critical wildlife habitats, resource-based structures, such as farming, forestry, fishing, tourism and recreation also suffer.

Most communities often find themselves in a corner; they desire economic development, but are also concerned that the financial, environmental, and social costs of sprawl will outweigh the benefits of that growth. With careful planning, however, economic growth can flourish while preserving the character of our communities. Community Preservation is not a "no growth" policy. Instead, Community Preservation promotes pro-active and careful decision-making to direct future development to the most suitable locations. The goal of Community Preservation is to empower communities to develop a unique vision and plan for a future that compliments rather than conflicts with their environment, history, culture, and quality of life.

The Community Preservation Initiative forms partnerships on the local and state level and involves them in the planning process. Comprehensive planning involves a variety of issues and a diversity of interests and people. At the state level, Environmental Affairs partnered with the Department of Housing and Community Development (DHCD), the Department of Economic Development (DED), and the Executive Office of Transportation and Construction (EOTC) to spread the Community Preservation approach. This innovative, inter-agency partnership is crucial since environmental, housing, transportation and economic development are inextricably linked, and balanced thinking in local decision-making is essential.

Instead of using a top-down approach, Community Preservation empowers communities to define their own future and promotes environmental planning from the local level up. The Initiative seeks to empower communities by providing them with tools and programs that enable them to recognize the fiscal, environmental, and social impacts of different development options. Through a full understanding of the implications of land use decisions, communities will be able to make more informed choices regarding the legacy they leave for future generations.

Town Strategy: Optimize Use of Vegetation to Shade Buildings and Reduce the Urban Heat Island Effect
Projected GHG Reduction by 2009: Unknown
Implementation year(s): Ongoing

Vegetation cools the environment in summer both by shading buildings, cars, parking lots, sidewalks, and streets, and through transpiration (giving off water vapor). It also removes approximately 50 pounds of CO₂ per tree per year from the atmosphere, storing it in roots, stems, and leaves. Effective vegetation management, which requires good on-site water management, will also help mitigate some of the anticipated changes in the weather due to climate change, such as more extreme storms, floods, and droughts. Both flooding and drought-induced water shortages can be reduced by re-using on-site water and maintaining healthy vegetation that increases water infiltration and absorption. Well-maintained trees are less likely to suffer or inflict damage due to high winds or snowfall. As the climate warms, it becomes increasingly important to reduce the urban heat island effect.

The tree canopy reduces the urban heat island effect, sequesters carbon, reduces gasoline evaporation from parked motor vehicles, and makes the city more visually attractive. Preserving existing trees is the key to increasing the canopy since mature trees provide significantly more canopy than recently planted trees. Most species of trees typically take many years to reach full capacity to sequester carbon. Vines and arbors can also be used in constrained spaces.

The Amherst Tree Initiative is a town-wide initiative that began in December 2004. It is a collaborative effort created out of an awareness that many of the mature shade trees lining the streets of Amherst are dying and being removed at a much faster rate than new trees are being planted to replace them. The goal of the initiative is to bring together people and organizations from all sectors of the community to develop an ongoing plan to increase the health, vitality, variety and well-being of the trees of Amherst. The initiative is envisioned to encompass aspects including educational, spiritual, financial, scientific, recreational, and artistic.

An official survey of shade trees located on Town-owned land and right-of-ways, in collaboration with the UMASS Amherst Forestry Department, is in the planning stages. As Amherst becomes more developed, many older trees close to busy roadways experience more challenging conditions than earlier in their growth. Especially along busy roadways, hardy, mature specimens of sensitive species currently exist that would not survive if replanted as young trees today, so it is important to boost maintenance efforts of old trees and new plantings and to plant trees wherever possible. For trees and other vegetation, nutrient-rich soil, sufficient water supply, and adequate drainage are crucial. Selecting locally appropriate species and minimizing the use of turf also help to lower both maintenance and energy costs. Good vegetation maintenance and on-site water management lowers storm drainage costs, prevents the loss of vegetation during droughts, and creates energy-savings for building owners.

Town Strategy: Encourage the Construction of Green Building
Projected GHG Reduction by 2009: Unknown
Implementation year(s): Ongoing

Designing green buildings involves different approaches and techniques than conventional design. It explicitly considers factors such as the energy efficiency of a structure and the level of air quality that will result. It requires tools such as energy modeling to support the design process. The aim of the green building approach is to construct buildings that are more durable, sited optimally, use less energy, provide a safe and comfortable indoor environment, and conserve natural resources – in other words, to minimize the environmental footprint of our built environment.

In 2001, a new energy code for commercial and high-rise residential buildings took effect in Massachusetts. The code affects the construction of new buildings and is projected to save 27 trillion btus of energy generation. It is estimated that, statewide, the new code requirements will reduce annual emissions of CO₂ by about 2.4 million tons, sulfur dioxide (SO_x) by about 14,500 tons, and nitrogen oxides (NO_x) by about 3,500 tons. The new code does not affect existing buildings except when they undergo major renovations.

INSTITUTIONAL LAND USE AND PLANNING STRATEGIES

HAMPSHIRE COLLEGE

Hampshire College Strategy: Sustainable Campus Plan

Projected GHG Reduction by 2009: Unknown

Implementation year(s): 2005

In 2005, Hampshire College completed its Sustainable Campus Plan, a land use master plan for the College. Through a highly participatory, community-based process, a plan was drafted that has the primary goal of furthering the sustainability of Hampshire College. From a land use perspective, four strategies were developed using five planning dimensions to guide decisions related to land stewardship and future development.

The four strategies are Land Stewardship, Core and Community Cohesion (academic related growth to be toward the campus core), Energy and Resource Management, and Community Partnership (designated parcels on the periphery of the campus that may be considered for Cultural Village and economic development projects). The five planning dimensions used to evaluate each strategy were Educate, Protect, Conserve, Renew and Evolve.

The College continues to work closely with its School of Natural Science to evaluate its use of energy, and professors and students regularly conduct research and experiments to determine ways in which renewable energy sources may be used with more frequency.

TOTAL ESTIMATED GHG REDUCTION FOR LAND USE AND PLANNING = UNKNOWN

TOTAL ESTIMATED GHG REDUCTION FOR CLIMATE ACTION PLAN = 140,635 TONS

III. COMMUNITY EDUCATION AND RESOURCES

ROLE OF RESIDENTIAL AND OTHER SECTORS IN AMHERST'S GHG EMISSIONS

To reduce greenhouse gas emissions, all community stakeholders will have to examine their practices that affect energy use, transportation, land use, and waste management and make appropriate changes. In order to realize the Town of Amherst's goal to reduce its greenhouse gas emissions, it is important to involve the entire community in addition to its governing body and key institutions. Climate change affects all sectors of Amherst: its businesses, churches and faith-based institutions, organizations and agencies, public schools, and individuals. To be successful, this Plan must be able to marshal resources and build community support. Actions and decisions that can help bring about the needed emissions reductions can range from simple household behavioral changes, such as line-drying clothes or ride-sharing once a week, to small or large investments in energy efficiency, such as buying compact fluorescent lamps or deciding to retrofit a commercial space in ways that capture all cost-effective, climate protection opportunities.

TOWN EDUCATION STRATEGIES



Town Strategy: Amherst's Renewable Energy Fair

The Energy Conservation Task Force has organized its first annual Renewable Energy Fair, to be held on the Town Common in October of 2005. This will be highly informative and fun event that will include many community partners, vendors, and representatives. The main focus of the event is to engage the entire community in learning about the Town's energy conservation efforts and ways for individuals and businesses to take an active role in helping to meet the Town's GHG reduction goals. The Fair will provide information about businesses, professional firms, organizations, and individuals offering sustainable

energy products and services to people in Amherst and the Pioneer Valley. On the Town Common, participants will find green-building contractors, solar water heating installers, architects, energy conservation specialists, business consultants, environmental educators, and many other useful resources. An education tent on the Common and community rooms at the nearby local library will host engaging presentations, workshops, and video screenings throughout the day. The Fair will coincide with the Western Massachusetts Electric Company's (WMECO) Change-a-Light Campaign. A raffle, free gift give-aways, children's activities, and entertainment will be among the highlights of the Fair. The Fair will include a major publicity and outreach component with a newly-developed brochure helping residents to understand how they can take an active role in lowering their own energy output.

Town Strategy: Public Relations and Marketing Program

The Town's Energy Conservation Task Force will develop a comprehensive public relations and marketing program to raise the public's awareness of the Town's Climate Action Plan and how households and businesses can participate in efforts to reduce greenhouse gas emissions. It will prepare programs and messages for public-access television, and radio. Examples of the action steps that may take place include:

- Develop several brochures targeted to the public. Distribution could take advantage of existing outreach efforts by others, such as inserts to utility bills;
- Create and promote strategies for communicating the effectiveness of energy conservation activities in the residential sector;
- Create and promote web-based and hard copy sources of information about energy efficiency measures and global warming; and

- Create and promote strategies for residents to participate in the development of environmentally sensitive zoning and building code standards.

Town Strategy: Earth Day Celebration

The Town of Amherst will help co-sponsor the annual Amherst Earth Day Celebration held every Spring. In past events, WMECO and the Town of Amherst sponsored an air conditioner turn-in. The goal of the turn-in event was to help residents save money, energy, and make their homes more comfortable by replacing older, inefficient room air conditioners with efficient, environmentally-friendly air conditioners. In exchange for turning in an old, working room air conditioner, residents received a \$50 rebate towards the purchase of a new ENERGY STAR®-qualified room air conditioner from Manny's TV and Appliance. In 2004, the turn-in was a great success and WMECO collected 130 air conditioners from local residents. Useful parts from old units are recycled and any unusable components are disposed of in an environmentally responsible manner. Reducing the use of inefficient air conditioners goes a long way in reducing energy consumption, conserving natural resources, and protecting the environment.



On the regional level, in 2003 WMECO customers retired, recycled and replaced over 1,600 air conditioner units with new ENERGY STAR qualified models. As a result, they reduced greenhouse gas emissions by over 3,200 tons over the lifetime of the equipment, the equivalent of removing over 430 automobiles from the road annually. On a larger scale, if just one in 10 homes in the United States used ENERGY STAR qualified appliances, the change to our atmosphere would be equivalent to planting 1.7 million new acres of trees.

Town Strategy: Hitchcock Center for the Environment's Sustainability Programs

The Town of Amherst will partner with the Hitchcock Center for the Environment to offer programs on sustainability. This includes their popular *Sustainable Sunday* series which provide hands-on, practical advice on how individuals can lower their ecological footprint. Each month a different topic is offered to help individuals understand their impact and how their own decision-making and consumer choices can translate to a significant reduction of GHG emissions in their community. This series is designed to be engaging and inspirational and will serve to build a body of highly enthusiastic and motivated individuals who have the tools and knowledge to make tangible changes in their own behavior. Workshops, presentations, and lectures will reflect the gamut of sustainable energy sources, such as wind, solar, biomass, efficiency, geothermal, and hydropower, all to address the critical importance of breaking the chain of dependence on petrochemicals.

Town Strategy: Greening the Roadways Festival

The Town of Amherst will help co-sponsor the annual *Greening the Roadways Festival* organized by the Pioneer Valley Electric Auto Association. This is an annual event where concurrent seminars on alternative transportation and lots of alternative vehicles are available to see and test. Examples include electric vehicles and gas/electric hybrids as well as vehicles that run on grease and biodiesel. Participants will learn about bike commuting and winter bicycling, and community efforts to expand the Rail Trail and the promotion of more greenways. This will be an event for the whole family and the whole community and it will continue on the theme of building hope and increased sense of community pride and connection.

Town Strategy: Bike Commute Week

The Town of Amherst currently partners with the Pioneer Valley Planning Commission, MassBike Pioneer Valley, community volunteers, and business and civic organizations to promote Bike Commute Week. This event is designed to encourage Pioneer Valley citizens to commute by bicycle to work, to school, and for short trips in their communities. The Town of Amherst actively participates in this event to promote commuting by bike.

Town Strategy: Amherst-Pelham School District Curriculum Development

The Massachusetts Department of Education's Science and Technology/Engineering Curriculum Framework includes many learning standards which can be met utilizing curriculum materials that focus on the use of energy resources and global warming. The Energy Conservation Task Force, in partnership with the Hitchcock Center for the Environment and others, will work with the Amherst-Pelham School District to provide access for educators to curriculum materials and resources that can be integrated into existing elementary, middle school, and high school academic programs, club activities, and after school programs. This will enable the school community to participate in the Cities for Climate Protection Campaign. Examples of action steps that may take place include:

- Create and promote professional development workshops for educators that acquaint educators with existing curriculum materials and resources.
- Assist educators in the integration of climate studies into academic, club, and after school programs.
- Develop a strategy for determining the compatibility of the study of energy resources and global warming with the mission of the Amherst schools.

OTHER EDUCATION STRATEGIES

Other Strategy: Western Massachusetts Electric Company's Energy (WMECO) Saving Programs

WMECO is committed to helping customers in Amherst conserve energy and save money. They offer a variety of products and services to help households manage their energy costs. Using WMECO's website, residents can start by calculating their energy usage. WMECO also offers Cool Smart with ENERGY STAR that offers rebates to keep households warm in the winter and cool in the summer, all while saving energy. WMECO also offers programs targeting those with special needs. Customers can visit the ENERGY STAR® section of WMECO's website (listed below) to see the latest in lighting and appliances for existing homes and obtain guidance in designing and building energy-efficient new homes. Customers can also purchase efficient lighting products at discounted prices through the ENERGY STAR® Lights Catalog. Other WMECO programs include:

- **MassSAVE**

In cooperation with other Massachusetts electric and natural gas utilities, WMECO has developed the MassSAVE program to educate and aid customers on saving energy. By contacting a toll-free, statewide hotline and answering a few simple questions, customers can receive valuable information on cutting their energy bills. Customers may also be eligible for an in-home survey and discounted energy-saving repairs. Customers who heat their homes with electricity, oil, or propane can contact MassSAVE at 1-800-666-3303 or visit MassSAVE for more information. Natural gas heating customers can call 1-866-527-7283 for information.

- **Energy Bucks**

Energy Bucks is a unique collaboration between WMECO, other statewide, investor-owned utilities, LEAN and MASSCAP. With just one phone call, customers can find out what energy programs they may be eligible for, regardless of whether they heat their homes with natural gas, electricity, or oil. Energy Bucks makes it easy for customers to find ways to save energy and money through discounted utility rates, energy-efficiency programs, and fuel assistance. For more information, call 1-866-537-6267 and Just Ask, or visit Energy Bucks for eligibility information and more.



- **The Change a Light, Change a World Campaign**

In partnership with the EPA, WMECO coordinates this annual campaign designed to raise consumer awareness about ENERGY STAR® qualified lighting fixtures and bulbs. This promotion is designed to help utilities, manufacturers, and retailers meet their lighting sales and energy savings goals with a single call to action for consumers.

Education Strategy: Renewable Energy Grant Programs

Grants offered through non-profit organizations, such as the Massachusetts Center for Ecological Technology, the Massachusetts Environmental Technology, and the New England Grassroots Environmental Fund present another avenue available to businesses, institutions, and residents seeking financial support of renewable and environmentally-friendly energy projects. See resources below for more information.

RESOURCES

The following list of resources is just a few of the many organizations that administer programs and services for individuals, businesses, and institutions both in the Pioneer Valley and statewide seeking to lower their greenhouse gas emissions. This is not an exhaustive list and the list of resources continues to grow as sustainable development becomes a growing local, regional, national, and international priority. We encourage every reader who wants to learn more about how to lower their impact on earth's resource they can explore these organizations more fully.

The Center for Ecological Technology (CET) is a non-profit (501c3) organization that demonstrates and promotes practical, affordable solutions to the environmental challenges encountered in our daily activities. CET's mission is "to research, develop, demonstrate and promote those technologies which have the least disruptive impact on the natural ecology of the Earth." From offices in Pittsfield, Northampton and Springfield, CET finds sustainable solutions to complex issues in order to benefit our environment, health, economy, and community. Website: www.cetonline.org

Clean Air-Cool Planet (CA-CP) creates partnerships in the Northeast to implement solutions to climate change and build constituencies for effective climate policies and actions. They partner with campuses, communities, and companies throughout the Northeast to help reduce their carbon emissions; help their partners, their constituents, and other regional opinion leaders and stakeholders understand the impacts of global warming and its best available solutions, through comprehensive outreach efforts celebrating commitment, innovation and success in climate action; showcase practical climate solutions that demonstrate the economic opportunities and environmental benefits associated with early actions on climate change; advocate the implementation of effective policy solutions aimed at reducing greenhouse gas emissions at the state and regional levels; and work to build support for the implementation and strengthening of the New England Governors and Eastern Canadian Premiers' regional Climate Change Action Plan. Website: www.cleanair-coolplanet.org

The **ENERGY STAR Program** was introduced by the U.S. Environmental Protection Agency (EPA) in 1992 as a voluntary market-based partnership to reduce air pollution through increased energy efficiency. Today, with assistance from the Department of Energy, the ENERGY STAR program offers businesses and consumers energy-efficient solutions to save energy, money, and help protect the environment for future generations. More than 7,000 organizations have become ENERGY STAR partners and are committed to improving the energy efficiency of products, homes and businesses. For more information about ENERGY STAR, visit www.energystar.gov or call toll-free 1-888-STAR-YES (1-888-782-7937).

The Hitchcock Center for the Environment is an independent, nonprofit, environmental education center located in Amherst and serving the Pioneer Valley for over 43 years. The Hitchcock Center's mission is to foster greater awareness and understanding of our environment and to develop environmentally literate citizens. Serving over 6,000 individuals each year, the Hitchcock Center provides award-winning environmental education programs in the areas of professional development and curriculum programs for teachers, field trips and

classroom presentations for area schools, preschool and summer camps for children, youth and families, and natural history programs for adults and the community at-large. The Hitchcock Center designs its programs to: 1) provide students of all ages with opportunities to construct their own understandings of the environment through hands-on, minds-on investigations; 2) involve youth and adults in direct experiences that challenge them to use higher-order thinking skills; 3) develop an active learning community where participants share ideas and expertise, and prompt continued inquiry; and 4) provide real-world contexts and issues from which concepts and skills can be used. Through various educational programs, we foster the awareness and appreciation that motivates us to serve effectively as environmental stewards. Visit the website at www.hitchcockcenter.org or call (413) 256-6006 for more information.

The Massachusetts Climate Action Network (MCAN) is dedicated to halting the threat of global climate change. They strive to reduce emissions of greenhouse gases, principally carbon dioxide, in our communities and the state. The MCAN Network is composed of local and statewide groups that have joined together in a cooperative effort. There are 14 local groups and four regional or statewide environmental groups in MCAN at present. The Town of Amherst joined MCAN in 2005. The group's efforts are principally devoted to conducting public education and influencing municipal governments in their home communities, to achieve local reductions in greenhouse gas emissions. MCAN is also striving to change climate policy at the state level in Massachusetts, through influencing the state's climate action plan; legislation related to energy efficiency, renewable energy, and transportation; and regional planning efforts. Website: www.massclimateaction.org

The Massachusetts Technology Collaborative (MTC) is the state's development agency for renewable energy and the innovation economy, which is responsible for one-quarter of all jobs in the state. MTC administers the John Adams Innovation Institute and the Renewable Energy Trust. They work to stimulate economic activity in communities throughout the Commonwealth. As their name suggests, MTC uses a collaborative approach to achieving the organization's mission. MTC brings together leaders from industry, academia, and government to advance technology-based solutions that lead to economic growth and a cleaner environment in Massachusetts. By developing energy from wind, solar, and other renewable resources, MTC is reducing reliance on coal, oil, and other fossil fuels that contribute to air pollution and global warming. Investments in the emerging clean energy market stimulate new economic activity in the renewable industry and job growth across Massachusetts. Technology-driven innovation fuels our economy. MTC is uniquely positioned to provide economic development solutions working with the Governor and State Legislature. By forming dynamic partnerships with key stakeholders, the agency serves as a catalyst for growing the innovation economy. Website: www.masstech.org

The Northeast Sustainable Energy Association (NESEA) is the nation's leading regional membership organization focused on promoting the understanding, development, and adoption of energy conservation and non-polluting, renewable energy technologies. For more than thirty years, NESEA has facilitated and enhanced a network of professionals, practitioners, and other citizens in pursuit of responsible energy use. NESEA's programs and activities focus on the northeastern United States, from Washington, DC to Maine. NESEA is a chapter of the American Solar Energy Society. NESEA recognizes and responds to the crucial connections between the generation and use of energy and the whole systems that sustain planetary health. NESEA envisions energy systems that interact to preserve and improve our air, water, resources and ecosystems, while vitalizing economies, building local security and regional self reliance, and improving the quality of all life. NESEA acts as a hub that connects people across a broad base of interests and disciplines. Its network of active citizens, professionals, businesses, and organizations in the Northeast seeks to discover and demonstrate the responsible production and use of energy. NESEA collaborates and cooperates with allied organizations to advance common interests. It celebrates, inspires, and nurtures visionary ideas, emerging markets, and practical solutions. Website: www.nesea.org

Western Massachusetts Electric Company (WMECO) provides electric power services to more than 200,000 customers in about 60 towns and cities in Massachusetts including Amherst. WMECO purchases its electricity from affiliate Select Energy. It is an operating subsidiary of Northeast Utilities, one of the largest utility companies in New England. Another subsidiary of Northeast Utilities, Northeast Utilities Service Company (NUSCO), provides accounting and administrative duties for Western Massachusetts Electric. A more detailed listing of some of their programs are described above. Website: www.wmeco.com

IV. Implementation And Monitoring

The Energy Conservation Task Force has played a central role in the development of this document. The process of creating it has demonstrated how individuals from various sectors of the community can effectively come together and organize around a clear and common goal. This same spirit of dedication and commitment will be required for the next phases of implementation, monitoring, evaluation, and problem-solving.

The Task Force will remain the central body that will oversee and advance the strategies outlined in the Climate Action Plan. It is proposed that membership of this group expand to include members of the school and business communities as well. As previously mentioned, the success of this Plan will require participation from all sectors of the community at large, including the residents of Amherst. The Task Force is recommended to include at least the following representatives:

- Three from Town departments,
- One each from Amherst College, Hampshire College and the University of Massachusetts, Amherst, and
- Four from the residential population and community groups.

A three-person subcommittee of representatives from each of the above sectors will facilitate the meetings and work of the Task Force.

IMPLEMENTATION STRATEGY

The Task Force will continue to meet on a monthly basis to support implementation, evaluation and progress towards the goals in the Climate Action Plan. Individual members will be assigned coordinating roles depending upon the relevance of the strategy to the particular sector that member represents. Members of the community at large will be engaged in the implementation of the individual measures through the outreach methods detailed in the Education and Resources of the Climate Action Plan.

Updates on individual efforts at regular Task Force meetings will serve to ensure that implementation continues forward momentum. As the Town of Amherst Climate Action Plan is a living document, additional strategies and measures will be created and incorporated into the plan on an annual basis. The Amherst community shall be given the opportunity to participate in the process of goal setting and prioritization prior to the annual budget season.

MONITORING STRATEGY

The Climate Action Plan shall be revised on an annual basis. The annual revision will be released prior to Fall Town Meeting and will include a “Progress Report and Work plan” section. This section will include updates on existing measures, successes from the past year, obstacles, and goals for the coming year. Emphasis will be placed on identifying the specific funding and support needs of Town departments and Amherst community members in order to achieve emissions reduction goals in the coming year. Reports on specific measures and an overall forecast as to how the 35 percent reduction target is being met will be produced utilizing the ICLEI software and included in the annual revision.

As individual goals and measures are met, the Task Force will assist members of the Amherst community and Town staff in:

- Assessing which measure(s) will be acted upon next,
- Assessing what resources and support we need to obtain to support members of our community and Town staff in implementing Plan goals,

- Assisting in efforts to obtain needed resources and support,
- Enlisting citizen support for implementing Plan goals, and alerting the broader community if resources are insufficient to advance the current year's goals.

Given the financial investments necessary to implementing many aspects of the Plan, efforts will be made by members of the Task Force to locate and pursue funding sources, or to recruit and support a team of volunteers to help in this work.

V. CONCLUSION

The effort to stabilize man-made greenhouse gases in the atmosphere will require a long-term commitment. The emissions reduction goals that are currently being set on local, national and international levels are the starting point for an unprecedented global effort to lessen the potentially devastating impacts of an environmental problem that can affect every person on this planet. Fortunately, the human race has a tremendous capacity for innovation and adaptation. The Task Force believes, and hopes, that this Climate Action Plan is the beginning of one small – but potentially important – demonstration of that capacity.

Much of what happens next, and for the next few years, will depend on the willingness of all the stakeholders to make a commitment to climate protection. Creative ideas and solutions are always welcome. The Task Force suggests that this Plan be thought of as a living document, and be revised and updated as necessary.

APPENDIX A: CITIES FOR CLIMATE PROTECTION CAMPAIGN (CCP)

COMMUNITY PER-CAPITA BASELINE INVENTORY EMISSIONS COMPARISONS

City or Town	Population	GHG Emissions (tons eCO ₂)	Per Capita (tons/person)	Baseline Year for Inventory	Year Inventory was Conducted
Santa Fe, NM	55,859	1,418,819	25.4	1990	
Newton, MA	82,585	1,973,540	23.9	1990	
Watertown, MA	33,284	695,675	20.9	1999	2001
Fort Collins, CO	87,758	1,673,861	19.1	1990	2001
Augusta, ME	18,553	349,552	18.8	2000	2001
Saratoga Springs, NY	26,186	470,135	18.0	2000	2001
Fairfield, CT	53,000	921,584	17.4	1994	2001
Cambridge, MA	101,269	1,695,117	16.7	1990	1999
New Haven, CT	123,626	2,026,201	16.4	1999	2001
Nashua, NH	86,605	1,301,817	15.0	2000	2001
Santa Cruz, CA	54,575	747,679	13.7	1990	
Northampton, MA	28,978	395,335	13.6	2000	2001
New Rochelle, NY	72,182	985,112	13.6	2000	2001
Buffalo, NY	309,035	3,966,716	12.8	1999	2001
Medford, MA	57,400	696,112	12.1	1995	2000
Gloucester, MA	29,456	351,908	11.9	1998	2001
Brookline, MA	54,718	626,512	11.4	1995	2000
Burlington, VT	39,127	438,931	11.2	1990	
Amherst, MA	34,874	380,904	10.9	1997	2001
Somerville, MA	77,098	751,729	9.8	1997	2001
Arlington, MA	43,835	335,063	7.6	1997	
County					
Suffolk County, NY	1,419,420	35,500,392	25.0	2000	2001
Tompkins County, NY	96,500	1,384,209	14.3	1998	2001
Westchester County, NY	905,572	11,943,626	13.1	1999	2001
State					
New York State	18,976,457	223,495,800	11.8	1999	
New York State	18,976,457	223,660,800	11.8	1999	

APPENDIX B: TOWN OF AMHERST, MA RESOLUTION FOR PARTICIPATION IN THE CITIES FOR CLIMATE PROTECTION (CCP) CAMPAIGN, APRIL 2000

WHEREAS, a scientific consensus has arisen that Carbon Dioxide and other greenhouse gases (GHGs) released into the atmosphere will have a profound effect on the earth's climate; and

WHEREAS, scientific evidence indicates that global warming is already beginning, with the 1990's the hottest decade in recorded history; and

WHEREAS, based on scientific evidence, the United States has pledged along with 160 countries under the United Nations Framework Convention on Climate Change to reduce its greenhouse gas emission;

WHEREAS, energy consumption, specifically the burning of fossil fuels, e.g. coal, oil, and gas, accounts for more than 80 percent of U.S. GHG emissions; and

WHEREAS, local governments greatly influence their communities energy use by exercising key powers over land use, transportation, building construction, waste management, and, in many cases, energy supply and management; and

WHEREAS, local government actions taken to reduce GHG emissions and increase energy efficiency provide multiple benefits by decreasing air pollution, creating jobs, reducing energy expenditures, and saving money for the local government, its businesses and its citizens; and

WHEREAS, the Cities for Climate Protection Campaign, sponsored by the international Council for Local Environmental Initiatives, has invited the **Town of Amherst** to become a partner in the campaign;

NOW THEREFORE IT BE RESOLVED that the **Town of Amherst** pledges to join with jurisdictions from all over the world in the Cities for Climate Protection Campaign and, as a participant in the Cities for Climate Protection Campaign, the **Town of Amherst** pledges to

1. Take a leadership role in increasing energy efficiency and reducing GHG emissions from municipal operations;
2. Develop and implement a local Action Plan that describes steps Amherst will take to reduce both GHG emissions and air pollution emissions; the Plan will include
 - A greenhouse gas emissions analysis and forecast to determine the source and quantity of ghg emissions within the Town;
 - A carbon dioxide or GHG emissions reduction target;
 - The strategy for meeting Amherst's GHG reduction target, with an outline of the programs and measures that will be implemented to achieve the target.

APPENDIX C: TOWN OF AMHERST, MA RESOLUTION FOR PARTICIPATION IN THE AMHERST RENEWABLE ENERGY CAMPAIGN, AUGUST 2005

WHEREAS, the Town of Amherst Select Board committed to reducing its greenhouse gas emissions in April 2000 by joining the Cities for Climate Protection™ Campaign; and

WHEREAS, the Town's Climate Action Plan is set to be released Fall 2005; and

WHEREAS, the Town believes that clean energy is a wise investment to create a sustainable future for Amherst; and

WHEREAS, Clean Energy options are currently available to residents and small businesses in Amherst; and

WHEREAS, the Massachusetts Technology Collaborative has created the Clean Energy Choice Program to provide matching funds for green building and renewable energy technologies to cities and towns in Massachusetts in which residents participate in the Clean Energy Choice program;

NOW THEREFORE, BE IT RESOLVED, that the **Town of Amherst** commits to support a campaign to encourage residents to participate in the Clean Energy Choice Program and pledges to apply a portion of the program's matching funds generated in 2005 towards incorporating Green Building and Renewable Energy technologies into the renovations planned for the Hitchcock Center for the Environment building.

BE IT FINALLY RESOLVED, that the **Town of Amherst** requests assistance from ICLEI-Local Governments for Sustainability and the Center for Ecological Technology to implement a community-wide campaign to increase awareness of and participation in the Clean Energy Choice Program.

IN WITNESS, WHEREOF, we have hereunto voted and set our hands this eighth day of August, 2005.

APPENDIX D: AMHERST CRITERIA AIR POLLUTANTS REDUCTIONS IN 2009

TARGET YEAR (2009) MEASURES SUMMARY

	NOx (lbs)	SOx (lbs)	CO (lbs)	VOC (lbs)	PM10 (lbs)
Commercial Sector	23,226	108,298	20,149	1,834	18,330
Transportation Sector	10,420	630	126,334	12,565	286
Total	33,646	108,928	146,483	14,400	18,616

APPENDIX E: TOWN OF AMHERST GREENHOUSE GAS EMISSIONS INVENTORY

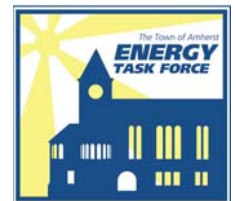


The Town of Amherst Massachusetts

GREENHOUSE GAS EMISSIONS INVENTORY



Prepared by the Town of Amherst
Energy Conservation Task Force
Inventory Conducted: August 2001
Report Revised: December 2004



The Town of Amherst Energy Conservation Task Force consists of the following members:

Larry Archey	Hampshire College
Jason Burbank	UMASS Amherst
Stephanie Ciccarello	Town of Amherst
Tina Clarke	Amherst Resident
Barry Del Castilho	Town of Amherst
Aaron Hayden	Amherst College
Julie Johnson	Hitchcock Center for the Environment
Karen Jones	Amherst Transportation Subcommittee
Niels LaCour	Town of Amherst
Steve Roof	Hampshire College
Rob Snyder	Amherst Resident
Amy Verel	Graduate Intern, UMASS Amherst

Special thanks to the following individuals who have contributed to the development of the Cities for Climate Protection Process:

David Ahlfeld	Amherst Resident
Anne Awad	Amherst Select Board
Bart Bales	SolarWorks
Glenn Barrington	UMASS Transit
John Coull	Amherst Chamber of Commerce
Marc Fournier	UMASS Amherst
Hwei-Ling Greeney	UMASS Sustainable Operations
Carolyn Holstein	Town of Amherst
Marianne Jakus	Amherst Transportation Subcommittee
Van Kaynor	Amherst Transportation Subcommittee
Ann Kearns	Amherst Resident
Ned Markert	Town of Amherst
Martha Nelson	UMASS Amherst
Ludmila Pavlova	UMASS Amherst
John Pepi	UMASS Amherst
Lindsay Stromgren	Town of Amherst
Peter Westover	Town of Amherst

TABLE OF CONTENTS

<u>INTRODUCTION.....</u>	<u>5</u>
 <u>THE INTERNATIONAL COUNCIL FOR LOCAL ENVIRONMENTAL INITIATIVES AND CITIES FOR CLIMATE PROTECTION</u>	<u>8</u>
 <u>THE TOWN OF AMHERST’S GOALS AND OBJECTIVES</u>	<u>9</u>
 <u>EMISSIONS INVENTORY METHODOLOGY</u>	<u>9</u>
 <u>COMMUNITY EMISSIONS PROFILE</u>	<u>11</u>
 <u>GOVERNMENT EMISSIONS PROFILE</u>	<u>13</u>
 <u>INVENTORY DATA SOURCES AND CALCULATIONS</u>	<u>17</u>
 <u>COMMUNITY DATA.....</u>	<u>19</u>
COMMUNITY ELECTRICITY DATA	19
COMMUNITY NATURAL GAS DATA.....	19
COMMUNITY HEATING OIL DATA	19
COMMUNITY PROPANE DATA	20
COMMUNITY TRANSPORTATION DATA.....	20
COMMUNITY COAL DATA	21
 <u>GOVERNMENT OPERATIONS DATA</u>	<u>21</u>
GOVERNMENT ELECTRICITY, NATURAL GAS, PROPANE AND HEATING OIL DATA	21
GOVERNMENT VEHICLE FLEET DATA.....	21
GOVERNMENT WASTE DATA	21
 <u>RECOMMENDATIONS.....</u>	<u>22</u>

APPENDIX A: TOWN OF AMHERST, MASSACHUSETTS RESOLUTION FOR PARTICIPATION IN THE CITIES FOR CLIMATE PROTECTION CAMPAIGN..... 23

APPENDIX B: CITIES FOR CLIMATE PROTECTION CAMPAIGN (CCP) COMMUNITY PER-CAPITA BASELINE INVENTORY EMISSIONS COMPARISONS 24

APPENDIX C: COMMUNITY GREENHOUSE GAS EMISSIONS IN 1997 25

APPENDIX D: GOVERNMENT GREENHOUSE GAS EMISSIONS IN 1997 26

Introduction

Climate change, accelerated by human activity-generated "greenhouse gases," is one of the largest public policy issues facing society today. Scientific models predict that global warming could cause significant economic, social and ecological impacts. While the future of our earth's climate cannot be conclusively known, the potential scale and irreversibility of these impacts are prompting leaders at the local, national, and international levels to adopt action plans for climate protection. One program assisting local communities is called Cities for Climate Protection.

The science shows there is new and stronger evidence that most of the observed warming over the last 50 years is attributable to human activities.

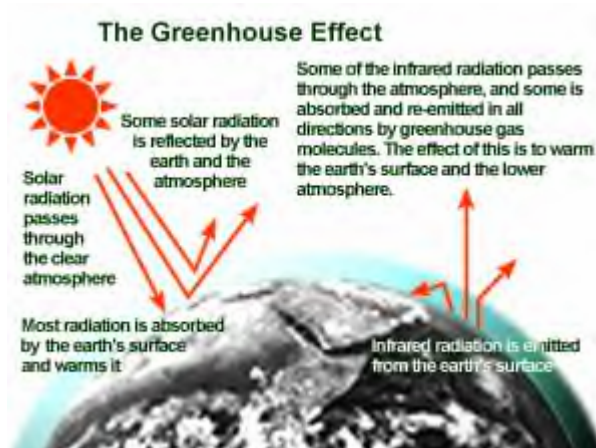
The year 2000 report by the International Panel on Climate Change indicates that it is now considerably clearer than at the time of their last comprehensive report in 1995 that the addition of greenhouse gases to the atmosphere by is changing the global climate.

The basics of global warming can be summarized as follows. Energy from the sun enters the atmosphere as light, and heats the earth's surface. The heat is radiated back into space, especially at night. Atmospheric greenhouse gases naturally present in the atmosphere trap some of the outgoing energy, retaining heat somewhat like the glass panels of a greenhouse and prevent an extreme dip in temperature. The earth normally sheds heat into space at approximately the same rate it absorbs the energy from the sun. This process is depicted in the diagram 1 below.

The Greenhouse Effect

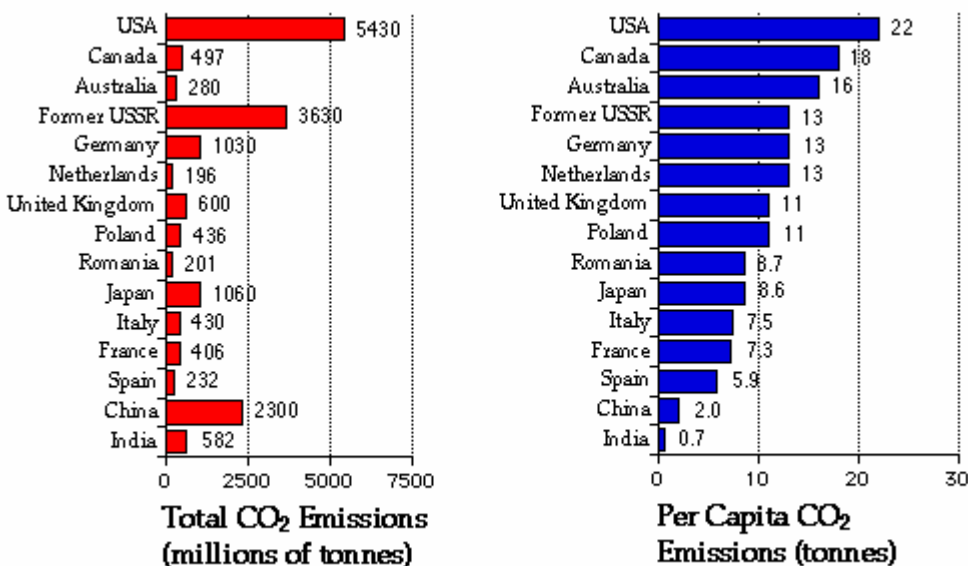
Problems arise when the atmospheric concentration of greenhouse gases increases and upsets the equilibrium of these gases naturally present in the atmosphere. Global warming refers to the increasing warming of the earth because of the increase in greenhouse gases in the atmosphere.

Scientists believe that the burning of fossil fuels, the destruction of forests and other human activities are the primary reason for the observed increased concentration of carbon dioxide in the atmosphere. Energy burned to run cars and trucks, heat homes and businesses, and power factories is responsible for about 80 percent of society's total carbon dioxide emissions. Human industrial activities annually emit the equivalent of 8.3 billion tons of carbon dioxide into the atmosphere. Trees, plants, and oceans reabsorb 60 percent of this carbon. However, the remaining 40 percent increases the atmospheric level of greenhouse gases, magnifying the planet's natural warming mechanism and increasing temperature worldwide.



Since the mid-1980s, 20.5 billion tons of carbon dioxide or more has been and continues to be released into the atmosphere annually. The industrialized world, where only one-third of the planet's population lives, produces 80 percent of that amount. Industrialized countries use most of the world's fossil fuels and thus carry the main responsibility for global warming. Diagram 2 illustrates this contention. The United States has a substantial lead on all countries, both in CO₂ emissions per capita and in total CO₂ emissions production.

Diagram 2: Countries Producing the Most CO₂ Emissions



Source: Enquete-Commission, 1989

Carbon dioxide output is also intricately connected to air quality. Here in the Pioneer Valley, we are vulnerable to trapped smog and pollutants because of the topography of the land. Ozone is a dangerous atmospheric component that is found in high concentrations in the Valley. Lowering greenhouse gases will have the parallel effect of improving the air quality and health in the area.

Besides health and local air considerations, the global implications associated with excessive carbon dioxide emissions are serious and diverse:

Health Impacts:

1. Increases in respiratory diseases such as asthma
2. Increases in infectious diseases such as encephalitis, malaria, West Nile virus and Lyme disease as mosquito and tick populations grow with increases in temperatures

Environmental Impacts:

1. The anticipated rise in global temperature over this century has increased from a range of 1 - 3.5° C in the 1995 IPCC Report, to 1.5 - 6°C.
2. 20th century trends of increasing temperature, sea-level rise, and increased precipitation will continue and intensify in the 21st century.
3. There is likely to be an increase in extreme weather events such as heat waves, increased precipitation leading to floods, and higher minimum temperatures and fewer cold days

4. Mass migration of flora and fauna and ecosystems; extinction of those that cannot migrate
5. The anticipated range of global sea level rise is now between 14 and 80 cm, with a mid-range estimate of about half a meter

Many of the most dramatic effects will occur in already-impoverished lands and will be felt by people with the least means to counter the changes. Governments in northern, industrialized nations will be more financially able to defend their communities, but the strain will be great.

According to the IPCC, to reduce future climate damage and to stabilize at the change level that has already occurred would mean cuts in greenhouse gas emissions worldwide of 70 percent starting today. This number is huge, but every reduction effort will bring the planet one step closer to that goal.

For more information please refer to the International Panel on Climate Change, which has the most comprehensive scientific data, economic analyses and policy recommendations: www.ipcc.ch

The International Council for Local Environmental Initiatives and Cities for Climate Protection

The International Council for Local Environmental Initiatives (ICLEI) is an association of municipal governments dedicated to the prevention and solution of global environmental problems through local initiatives. Over 600 municipalities from around the world have joined as members. ICLEI was launched in 1990 as an international environmental agency for local governments under the sponsorship of the United Nations Environment Program, the International Union of Local Authorities (IULA), and the Center for Innovative Diplomacy. ICLEI maintains a formal association with IULA and has official consultative status with the United Nations through which it advocates the interests of local government before international bodies. ICLEI's mission is to build and support a worldwide movement of local governments to achieve tangible improvements in global environmental conditions through the cumulative impact of local actions.

In 1993, ICLEI began the Cities for Climate Protection Campaign (CCP) to assist local governments in addressing the pressing threat of global climate change. As such, CCP is a worldwide campaign to slow the earth's warming trend and to improve air quality and community livability. CCP enlists municipalities of all sizes to prepare and enact plans to reduce energy consumption and associated greenhouse gas emissions. The campaign presently includes 626 municipalities from around the world that account for eight percent of global greenhouse gas emissions. In the United States, CCP communities are currently responsible for 19 percent of all U.S. emissions. A variety of technical assistance is available through the program to help focus on innovative approaches to implementing energy-efficiency measures in municipal and commercial buildings, reducing greenhouse gas emissions through land-use planning, and developing strategies to reduce emissions in the transportation sector.

The Cities for Climate Protection Campaign involves a five-milestone process to achieve greenhouse gas emissions reductions. The five milestones are as follows:

1. **Milestone One:** Conduct a baseline emissions inventory for the entire community and municipal operations. From the baseline data, emissions growth or decline is forecasted 15 to 20 years ahead, assuming no actions are taken to address greenhouse gas emissions. ICLEI provides a software utility that calculates equivalent carbon dioxide emissions* from the various sources. This report is the conclusion of Milestone One.
2. **Milestone Two:** Set an emissions reduction target. Many community targets have been set at 20 percent below the base year emissions level (ex: Toronto) and use their projection year as the target year for obtaining these emissions reductions.
3. **Milestone Three:** Develop a local action plan or a collection of initiatives to reach the target reductions. This step is refined from the results of the emissions inventory.

* Equivalent carbon dioxide (eCO₂) is a term that compares the strength of various greenhouse gases. For example, methane has a heat-trapping or global warming potential 21x more powerful than CO₂. By describing the eCO₂ of methane emissions from a landfill, the direct global warming impact can be compared to the eCO₂ emissions of a diesel truck

4. **Milestone Four:** Implement actions. This milestone involves municipal government to formally adopt emission reduction initiatives. Further, various municipal departments may be called upon to coordinate and implement the adopted initiatives.
5. **Milestone Five:** Monitor emission reductions. Monitoring and verification of progress on the implementation of actions to reduce emissions is an ongoing step that begins once measures are implemented. ICLEI's software tool assists in the quantification of emissions reductions and allows for convenient reporting of results.

The Town of Amherst's Goals and Objectives

Overall Goal:

By passing the Cities for Climate Protection resolution (Appendix A), the Amherst Select Board adopted the goal to reduce emissions of gases and air pollutants that contribute to global climate change and local air quality degradation. The parallel goal is to an increase quality of life and operational efficiency of local systems.

Specific Objectives:

1. Raise general public awareness of global climate change and the sources of greenhouse gases
2. Implement public programs to increase energy and transportation efficiency and green, non-carbon-based fuels in order to reduce Amherst's greenhouse gas emissions contributions to the global problem of climate change
3. Develop initiatives within the municipal government reducing emissions of greenhouse gas emissions while simultaneously increasing operational cost efficiency of local government

Emissions Inventory Methodology

2004 Addendum: In the fall of 2004, an upgraded version of ICLEI's Clean Air Software allowed for a substantively improved analysis of the 2001 inventory data. Earlier software versions interpreted Amherst's carbon dioxide emissions using Massachusetts statewide electricity coefficients. By contrast, the new software uses coefficients from the Regional Electricity Grid, which produces a more accurate characterization of the emissions profile of the town.

The baseline year for the Amherst greenhouse gas emissions inventory is 1997 (though in certain cases 1998 data was substituted). This appears to be the earliest year for which reliable data could be gathered. However, some data from 2000 was also collected and occasionally used to supplement the analysis herein. The forecast year chosen for this analysis is 2015.

The emissions inventory and forecast are separated into two areas. The first is a community-wide assessment of all energy-consuming activities that occur inside the boundaries of the Town of Amherst. Specifically, this portion of the analysis examines emissions from electricity, natural gas, and heating oil consumed by the residential, commercial, and industrial sectors

within the Town. It includes emissions produced by personal and commercial vehicles driven on roads within the town. Methane emissions from landfill waste are also included.

The second section of the inventory is an examination of the emissions created by municipal operations of the Town of Amherst (referred to herein as the government inventory). This portion of the analysis includes the amount of electricity, natural gas, gasoline, diesel, and heating oil consumed by all municipal facilities and properties (including buildings, lighting, and vehicles) and an estimation of waste produced for the 1997 fiscal year. It is important to note that operations not directly under the control of the municipal government (i.e. private contractors for the Town of Amherst) are not included in the inventory.

This emissions inventory is thorough in its scope, but limited in depth. In both analyses, the CCP emissions report looks only at carbon dioxide produced from the burning of fossil fuels and methane from landfill waste. It does not attempt to calculate any other greenhouse gas emissions, including, (something that is probably significant for Amherst) methane from farm animals, and very strong heat-trappers like hydrofluorocarbons. CCP looks only at carbon dioxide and methane because these are the two greenhouse gases that local governments have the greatest potential to influence. Together these two gases comprise more than 80 percent of a given locale's eCO₂.

Both sections of the inventory involved collecting data and other technical information from utility companies, regional planning agencies, non-profit organizations, municipal bills, municipal purchase orders, and scholarly texts. The Community and Government Operations Data sections of this report follow the Emissions Profile sections, and include comprehensive lists of the data sources used for the inventory and forecast. Individuals with questions pertaining to this information can direct correspondence to the listed person or web site.

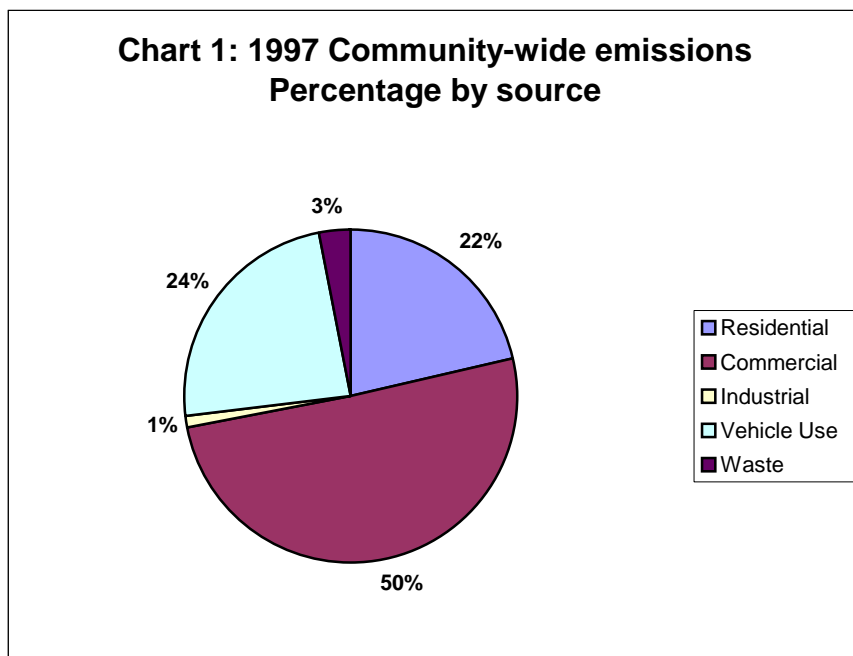
Community Emissions Profile

According to the calculations detailed later in this report, the Town of Amherst produced 289,539 tons of equivalent carbon dioxide in 1997. With a population of 34,874 in 2000, Amherst's per capita rate of emissions is approximately eight tons. While this is a moderately low rate in the range of per capita emissions for U.S. CCP communities (see Appendix B), it is still high relative to international per capita emissions. The United States produces 25 percent of the world's greenhouse gases with less than five percent of the world's population, and nation-wide per capita emissions continue to rise. Other countries, particularly those in Europe, have similarly high (or higher) standards of living and substantially lower emissions rates. Secondly, Amherst is an area without significant industry (unless farming is counted), which would increase greenhouse gas emissions. Emissions from tractor miles driven off-road and methane emissions from cows also do not get added to this calculation, though they may be significant.

The commercial sector of Amherst (including the University of Massachusetts, Hampshire and Amherst Colleges) accounts for fully half of the town's emissions and more than double that of the residential sector. The largely institutional nature of the commercial sector emissions presents the Town with unique advantages to consolidate efforts for implementing future emissions reduction measures.

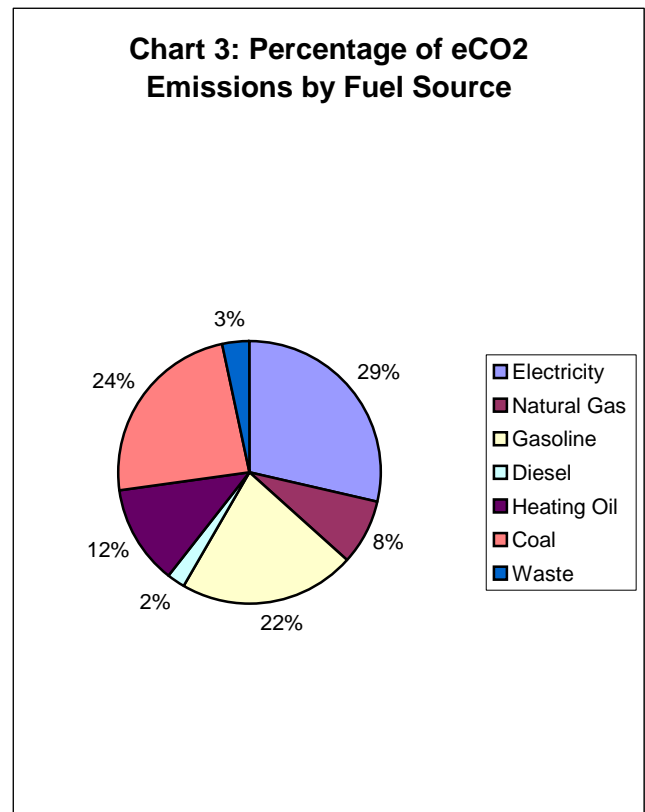
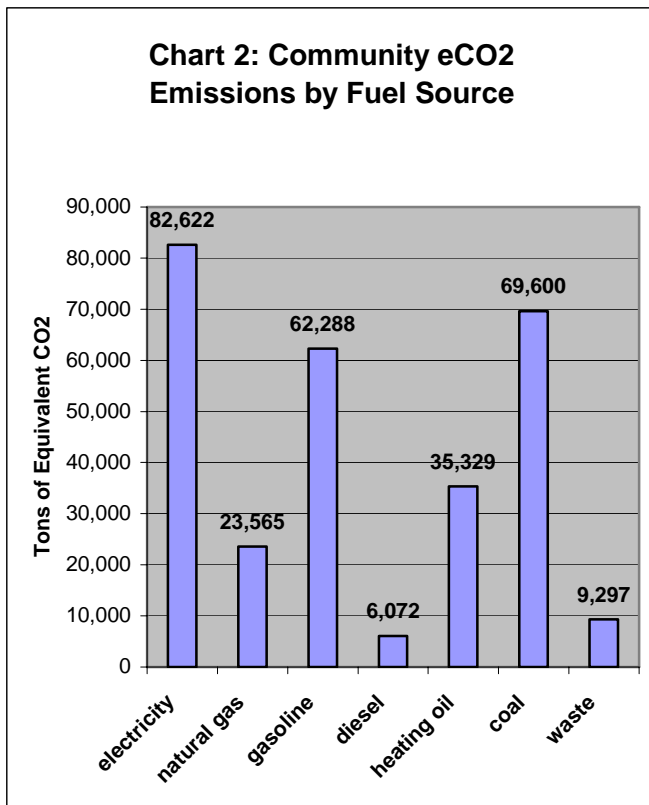
Table 1: Equivalent Carbon Dioxide Emissions by Sector for the Town of Amherst

Year	Residential	Commercial	Industrial	Vehicle Use	Waste
1997	62,823 tons	147,608 tons	687 tons	69,124 tons	9,297 tons



Two factors skew the output of Amherst greenhouse gases in the commercial sector. First, inadvertently due to primary metering, the university and college dormitories or other homes were included as commercial, though they are residences. Secondly, a significant factor is the coal and oil powered heat plant at the university. The coal burned there accounts for 24 percent of the town's overall emissions (i.e. 24 out of the 50 percent commercial emissions come from this plant). Fortunately, the university is in the process converting this plant to natural gas.

These details indicate that the CCP software sector differentiation was somewhat arbitrary for Amherst. A more appropriate version for Amherst would have used something more like residential, commercial and institutional as the three sectors, but the confines of the software limited the application of this difference. A breakout of the town's emissions by source, as in Charts 2 and 3, provides a more instructive analysis.



Electricity is the main energy source contributing to carbon dioxide emissions in Amherst. Coal and gasoline are in second place, and heating oil is in third place. Waste and diesel are the smallest emitters. This is the type of information that can help refine the procedure of creating a reduction goal and Local Action Plan for the town.

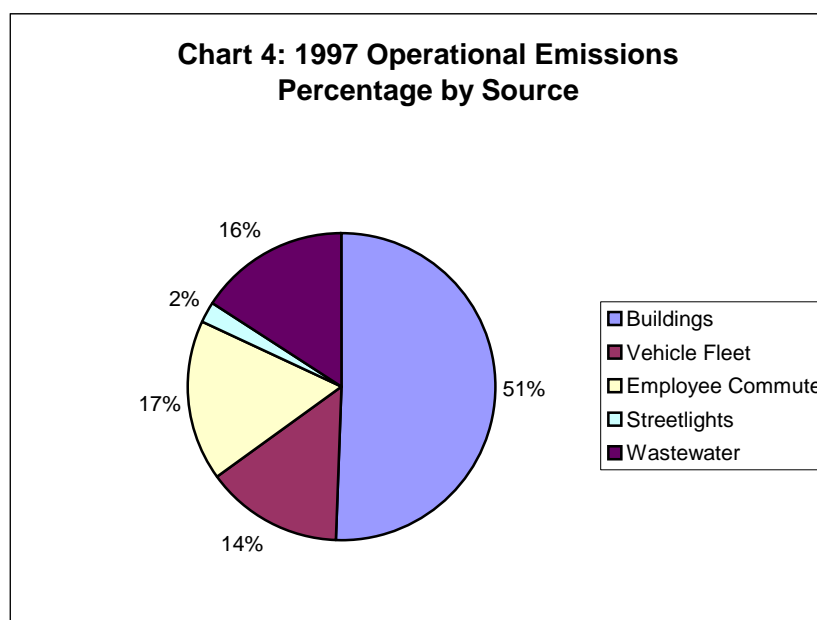
See Appendix C for detailed inventory results on community sector emissions.

Government Emissions Profile

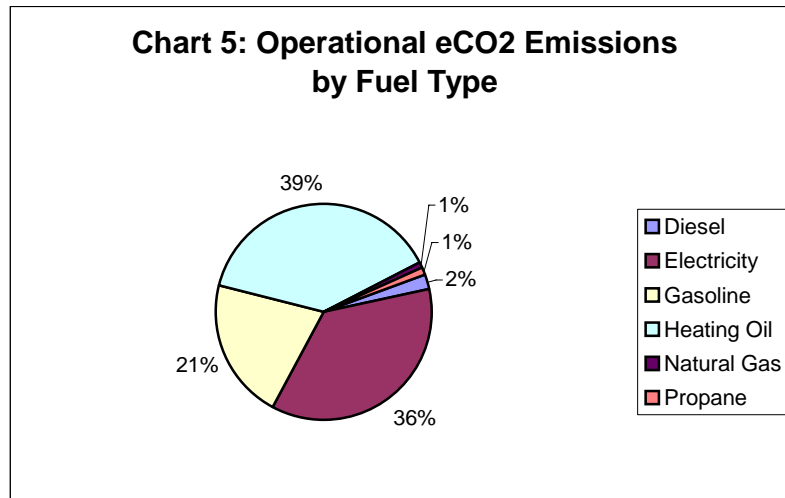
The municipal operations of the Town of Amherst generated 10,707 tons of carbon dioxide in the 1997 fiscal year. This represents approximately four percent of the community's net carbon dioxide emissions. Buildings account for about 51 percent of the municipal government's emissions, and vehicle fleet for 14 percent. Employee commute accounts for 17 percent of emissions; this figure was derived from a survey sample of 50 town employees on their vehicle type and commuting habits. Water and sewage-related energy usage account for 16 percent. Other waste is counted only once for the entire town and in the community analysis, which is why no specific "waste" category appears in this section. Energy usage for traffic signals is accounted for in the streetlights category.

Table 2: Equivalent CO₂ Emissions by Category for Amherst Town Government

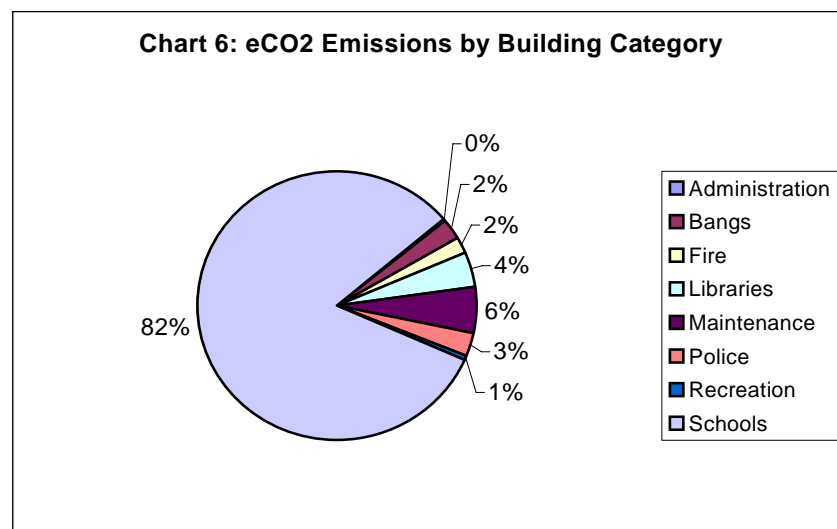
Year	Buildings	Employee Commute	Wastewater	Vehicle Fleet	Streetlights
1997	5,399 tons	1,827 tons	1,690 tons	1,563 tons	228 tons



Responsibility for the greatest percentage of emissions within the government analysis is closely split between heating oil (about 39 percent) and electricity (about 36 percent,) as displayed in Chart 5. Gasoline is the next largest contributor, at 21.5 percent; contributions from other sources are negligible.

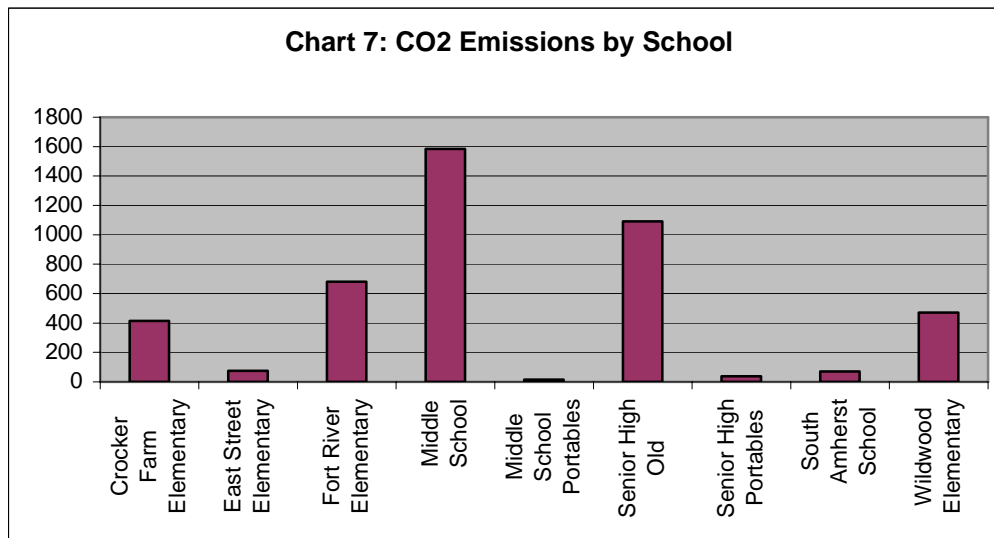


As mentioned previously, the Town's buildings are the largest contributors to carbon dioxide within the Government inventory. Collectively, the town buildings contributed 5,399 tons of carbon dioxide during 1997. According to Chart 6, it is apparent that schools were the largest contributors of green house gas emissions of all municipal buildings, producing about 4,449 tons of carbon dioxide, or 32 percent of *total* municipal emissions and 82 percent of emissions from buildings and facilities. Maintenance operations were the second largest source of emissions, accounting for about 301 tons of carbon dioxide, and libraries were third, contributing 233 tons. Administrative offices (i.e. Town Hall) were being renovated during 1997 and were therefore using very little electricity. A more recent year of data would be helpful to compare emissions output for the Town Hall.



It is important to note that the CO₂ output of the *regional* schools is not portioned out. The middle school and high school are regional and include students from three other towns. Amherst sends the most students to these schools and has the largest cost share, but should not account for *all* greenhouse gas emissions. Rather than attempting to derive a percentage of the school emissions for which Amherst is responsible, the regional schools' energy use has been

left whole. Realistically, reductions in energy use in these schools will have to be made on a regional level. Please refer to Chart 7 (on the following page) with this in mind.



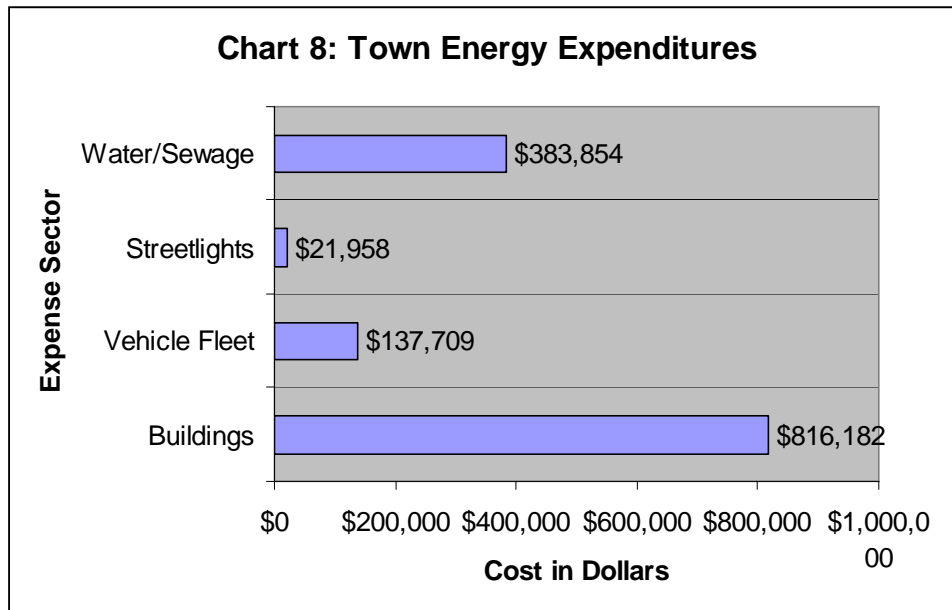
The largest single carbon dioxide-producing building in the town government is the Middle School, producing over 2000 tons of carbon dioxide. The old high school came in second for in terms of CO2 production, but is best compared with the “new” high school building, which opened in 1998.

The Town of Amherst’s vehicle fleet produced a total of 1,550 tons of carbon dioxide in the 1997 fiscal year. Of all the municipal departments, the vehicles operated by the department of public works were responsible for producing the most carbon dioxide (466 tons). School vehicles came in second (414 tons), and the police department’s vehicles were the third largest emitters at 382 tons. See Table 2 for a breakout of vehicular carbon dioxide emissions and fuel costs for each department in 1997.

Table 2: Carbon Dioxide Emissions and Fuel Costs for Department Vehicles for 1997

Town Department	CO ₂ Emissions (Tons)	Fuel Cost (\$)
Bangs and Council on Aging	10	1156
Building Maintenance	6	725
Cherry Hill	41	5212
Conservation	8	979
<u>Public Works</u>	<u>466</u>	<u>45,876</u>
Equipment Maintenance	316	31,515
Parks	40	3,835
Trees	35	3,418
Water	75	7,108
Fire	241	30,497
Leisure Service	8	970
Police	382	47,505
Schools	414	51,635

Reducing greenhouse gases can also benefit the municipal budget. The following graph shows a simple break-down of town energy costs.



Municipal buildings predictably represent the largest in energy costs to the town; this presents ample opportunity and justification for buildings-related emissions reductions in the Town's Climate Action Plan. Amherst's water and sewage energy costs are relatively high compared to other regional CCP town analyses, presenting another opportunity for cost and emissions reductions in the Climate Action Plan.

See Appendix D for detailed inventory results on government sector emissions.

Inventory Data Sources and Calculations

Community Electricity Data

Name: Liz Bellevue

Organization: Western Massachusetts Electric Company

Phone: 413/585-1746

Community Natural Gas Data

Name: Jen Bouchee

Organization: Berkshire Gas, rates and planning

Phone: 413/445-0353

Community Heating Oil Data

Name: Martha Leamy

Organization: Amherst Assessor's office

Phone: 413/256-4024

Publication Title: Northeast Heating Fuel Market: Assessment and Options

Publisher: Energy Information Administration, Department of Energy

Web Address: www.eia.doe.gov/oiaf/servicerpt/nehfuel/index.html

Information: Heating Degree Days

Organization: Data Collected at Amherst College

Contact: Paul Carlson, Schools

Community Vehicle Miles Traveled Data

Name: Dana Roscoe

Organization: Pioneer Valley Planning Commission

Phone: 413/781-6045

Community Indicator Data

Variables: Population, Households

Publication Title: 2000 Demographic Profile for Massachusetts, counties and places

Website: http://quickfacts.census.gov/cgi-bin/cnty_QuickLinks?25015, then navigate to Amherst

Community Coal Data

Name: Patrick Daly

Organization: University Utilities Department

Phone: 413/545-0605

Community Waste Data

Name: Yuehlin Lee

Organization: Town Recycling Coordinator

Phone: 413/256-4049

Government Electricity Data

Name: Maria Racca

Organization: Town Accounting

Phone: (413) 787-6150

Name: Cheryl McNamee

Organization: Amherst Department of Public Works

Phone: 413/256-4050

Email: mcnameec@amherstma.gov

Name: Paul Carlson

Organization: Town and Region schools

Phone: 413/549-9806

Government Natural Gas Data

Name: Maria Racca

Name: Cheryl McNamee

Government Heating Oil Data

Name: Maria Racca

Name: Cheryl McNamee

Name: Paul Carlson

Government Vehicle Fleet Data

Name: Vera West

Organization: Amherst Fire Department

Phone: 413/256-4082

Name: Paul Carlson

Government Waste Data

Name: Kathy

Organization: Human Resources

Additional Information: www.epa.gov/epaoswer/non-hw/muncpl/factbook/internet/mswf/gen

Community Data

Community Electricity Data

Estimations for the amount of carbon dioxide emitted from electricity consumption are based on information provided by Liz Bellevue at Western Massachusetts Electric Company. Bellevue provided electricity consumption numbers in megawatt hours for 1998 (1997 was unavailable). However, it was not divided by sector. The researcher used the percentages of year 2000 to define 1998 by sector. These estimates are as follows: the residential sector consumed 77,132 megawatt hours of electricity (31 percent), the commercial sector consumed 170,549 megawatt hours of electricity (68.18 percent), and the industrial sector consumed 1,326 megawatt hours of electricity (0.72 percent). Bellevue notes that these estimations are based upon metered accounts and do not include un-metered accounts. Therefore, electricity consumption may be slightly under-estimated since un-metered accounts are not included in the analysis. Also, the university and colleges are on primary meters, which include campus residences, enlarging the “commercial” sector. No forecast was available for any year.

Community Natural Gas Data

Natural gas consumption data was available from Jen Bouchee at Berkshire Gas. This utility does not divide their sales by town, but by district. Amherst is a part of their Greenfield division. In order to extrapolate the gas usage in Amherst, the researcher took the June 1998* number of Amherst customers (13,068) as a percentage of customers in the area (19 percent) and multiplied that by the 1,967,869 MCF (1000 cubic feet) of gas sold to get 373,895 MCF sold to Amherst.

Berkshire Gas only had information on residential sales, not commercial or industrial. Using their Greenfield Division Residential totals by month, it was determined that 24.5 percent of that division’s sales were to residences. The researcher extrapolated that natural gas usage was probably similar to electrical usage for local industry and thus assumed 0.72 percent of Amherst gas sales were to industry. Forecast information is not public.

*Berkshire Gas, too, only had records back to 1998 (this is fiscal year July-June, unlike WMECO, which provided January-December information.)

Community Heating Oil Data

Unlike electricity and natural gas that have single providers, heating oil service can come from literally hundreds of different servicers. Thus, the heating oil consumption for each sector was calculated using secondary sources. The following provides a detailed outline of the procedures used for the inventory:

Residential Sector

The total square footage and number of commercial, residential and industrial spaces in town that heat with oil. Residential does not include dorms, but does include fraternities/sororities.

The square feet of living space heated by oil in Amherst equals 5,545,986 (from Martha in Assessor’s office). This was multiplied by the national average usage of 0.374 gallons per sq. ft. (from 1997 DOE Study www.eio.doe.gov/oiaf/servicerpt/nehfuel/index.html), and then by the percent of difference between Amherst 1997 heating degree days and the national average

(1.2555 percent - based on data collected by Amherst College and used in public school system records) to get 2,604,156.4 gallons of heating oil used.

To refine this number, it was averaged with a number derived from a second type of calculation. The number of Amherst homes heated with oil (from www.umass.edu/miser), 3135, multiplied by 719 - the national average gallons heating oil used *per home* (www.eia.doe.gov) - and then by 1.2555 percent to accommodate the temperature difference. The result was 2,829,978.6 gallons.

Since both calculations resulted in close numbers, one can have confidence in the accuracy of their average: 2,717,067.5 gallons.

Commercial Sector

The first calculation under residential was utilized for commercial and industrial, but with slightly different standards. A 1995 DOE study (www.eia.doe.gov) shows that commercial use of heating oil is 0.36 gallons/square foot/year, slightly less than residential. Square footage of commercial and “mixed-use” space heated by oil in town is 716,879. This number was multiplied by 0.36 then by 1.2555 (degree days factor) to get 324,014.97 gallons.

Industrial Sector

The same standard of usage was assumed for commercial (0.36 gallons) as for the 27,894 square feet of industrial space heated by oil to get 12,607.5 gallons.

Community Propane Data

Like heating oil, propane is distributed by hundreds of different providers so a secondary calculation is called for.

Residential

The total number of Massachusetts households (2,621,989) and then Amherst households (9,174) as a percentage of that (0.35 percent) (from the 2000 census). The total residential propane use for the state was 5.8 trillion btu (www.umass.edu/miser). This multiplied by 0.35 results in 0.0203 trillion btus or 20.3 billion btus.

Commercial

Commercial state propane usage was 1.0 trillion btu, so Amherst probably used 3.5 million btus (utilizing the same percentage for residences plus 2007 gallons specifically used by Amherst College – information given to me by Aaron Hayden.)

Industrial

Statewide industrial usage was 0.6 trillion btus of propane, making Amherst’s usage estimation equal 2.1 billion btus (using 0.35 percent.)

Community Transportation Data

Emissions from personal and commercial vehicles were calculated using daily vehicle miles traveled (a standard form of data collection) generated by Dana Roscoe at the Pioneer Valley Planning Commission. This information is based upon a regional transportation model that

consists of all federal aid eligible roadways (a total of 123.2 miles of roads). The daily number of 309,895 vehicle miles traveled (counts taken on weekdays) for 1997 was multiplied by 330 and then supplemented by an additional 10 percent to account for local road miles uncounted by PVPA. Experience from other CCP interns is that 10 percent is sufficient to count - this gives an estimated total of annual vehicle miles traveled within the Town boundaries. It does not include town resident or commercial driving beyond town limits. The national averages for vehicle fuel efficiency and for traffic make-up (percent of vehicle type) provided by the software were used to calculate carbon dioxide emissions.

Community Coal Data

The coal burned only includes data given to me by Patrick Daly in the Utilities Department of UMass. He told me that they burned 30,537 tons of coal in 1997 and 32,300 tons in 2000.

Government Operations Data

Government Electricity, Natural Gas, Propane and Heating Oil Data

The information used to estimate consumption of electricity, natural gas, propane and heating oil by municipal facilities is derived from utility bills and purchase orders for the 1997 fiscal year. Maria Racca in the accounting office, Cheryl McNamee in the Department of Public Works, and Paul Carlson in schools shared information from their energy spreadsheets, which the researcher understood included electricity bills for all departments and properties including but not limited to buildings, lighting, and other facilities. To obtain annual electricity consumption for each account, the amount of electricity in kilowatt-hours for each month per account was collected and then added together. Natural gas and heating oil bills for all buildings were added the same way.

Government Vehicle Fleet Data

Vehicle fleet information is calculated for each department from fuel purchase records maintained in the main school office (schools only) and the central fire department (all other departments). Gasoline and diesel consumption is reported separately for each department and vehicle. It proved difficult to accurately calculate the amount of fuel used by each vehicle accurately, but was possible to estimate consumption by department.

Government Waste Data

This information was not available directly. It was calculated indirectly by using an EPA average of 2.9 lbs./waste per day per employee in government. Amherst has 272 permanent employees and 411 part time or temporary employees (683 total). The four town elementary schools have 287 Town of Amherst employees. Regional schools employ 326 people, 40 percent of their pay comes from the town of Amherst so 40 percent of them were counted as town employees. The EPA average is for all government employees and thus counted part time the same as full time. In total, 242.6 tons of waste came from regular town employees and 157.7 tons came from school employees.

Recommendations

Other CCP towns and cities, such as Cambridge and Burlington, have successfully implemented the concept of a Task Force with regular meetings to address at least the next two CCP milestones – setting a reduction target and creating a local action plan. In the summer of 2001, there were three meetings of the Amherst Task Force to start this process. It is recommended that this Task Force continue to meet in an official form, ideally with an appointed staff person as the “hub” of Cities for Climate Protection issues with the town.

APPENDIX A: Town of Amherst, Massachusetts Resolution for Participation in the Cities for Climate Protection Campaign

WHEREAS, a scientific consensus has arisen that Carbon Dioxide and other greenhouse gases (ghg) released into the atmosphere will have a profound effect on the earth's climate; and

WHEREAS, scientific evidence indicates that global warming is already beginning, with the 1990's the hottest decade in recorded history; and

WHEREAS, based on scientific evidence, the United States has pledged along with 160 countries under the United Nations Framework Convention on Climate Change to reduce its greenhouse gas emission;

WHEREAS, energy consumption, specifically the burning of fossil fuels, e.g. coal, oil, and gas, accounts for more than 80 percent of U.S. ghg emissions; and

WHEREAS, local governments greatly influence their communities energy use by exercising key powers over land use, transportation, building construction, waste management, and, in many cases, energy supply and management; and

WHEREAS, local government actions taken to reduce ghg emission and increase energy efficiency provide multiple benefits by decreasing air pollution, creating jobs, reducing energy expenditures, and saving money for the local government, its businesses and its citizens; and

WHEREAS, the Cities for Climate Protection Campaign, sponsored by the international Council for Local Environmental Initiatives, has invited the Town of Amherst to become a partner in the campaign;

NOW THEREFORE IT BE RESOLVED that the Town of Amherst pledges to join with jurisdictions from all over the world in the Cities for Climate Protection Campaign and, as a participant in the Cities for Climate Protection Campaign, Amherst pledges to

1. Take a leadership role in increasing energy efficiency and reducing ghg emission from municipal operations;
2. Develop and implement a local action plan that describes steps Amherst will take to reduce both ghg emission and air pollution emissions; the plan will include
 - A greenhouse gas emissions analysis and forecast to determine the source and quantity of ghg emissions within the Town;
 - A carbon dioxide or ghg emissions reduction target;
 - The strategy for meeting Amherst's ghg reduction target, with an outline of the programs and measures that will be implemented to achieve the target.

APPENDIX B: Cities for Climate Protection Campaign (CCP) Community Per-Capita Baseline Inventory Emissions Comparisons

City or Town	2000 Population	GHG Emissions (tons eCO ₂)	Per Capita (tons/person)	Baseline Year for Inventory	Year Inventory was
Santa Fe, NM	55,859	1,418,819	25.4	1990	
Newton, MA	82,585	1,973,540	23.9	1990	
Watertown, MA	33,284	695,675	20.9	1999	2001
Fort Collins, CO	87,758	1,673,861	19.1	1990	2001
Augusta, ME	18,553	349,552	18.8	2000	2001
Saratoga Springs, NY	26,186	470,135	18.0	2000	2001
Fairfield, CT	53,000	921,584	17.4	1994	2001
Cambridge, MA	101,269	1,695,117	16.7	1990	1999
New Haven, CT	123,626	2,026,201	16.4	1999	2001
Nashua, NH	86,605	1,301,817	15.0	2000	2001
Santa Cruz, CA	54,575	747,679	13.7	1990	
Northampton, MA	28,978	395,335	13.6	2000	2001
New Rochelle, NY	72,182	985,112	13.6	2000	2001
Buffalo, NY	309,035	3,966,716	12.8	1999	2001
Medford, MA	57,400	696,112	12.1	1995	2000
Gloucester, MA	29,456	351,908	11.9	1998	2001
Brookline, MA	54,718	626,512	11.4	1995	2000
Burlington, VT	39,127	438,931	11.2	1990	
Somerville, MA	77,098	751,729	9.8	1997	2001
Amherst, MA	34,874	289,539	8.2	1997	2001
Arlington, MA	43,835	335,063	7.6	1997	
County					
Suffolk County, NY	1,419,420	35,500,392	25.0	2000	2001
Tompkins County, NY	96,500	1,384,209	14.3	1998	2001
Westchester County, NY	905,572	11,943,626	13.1	1999	2001
State					
New York State	18,976,457	223,495,800	11.8	1999	

APPENDIX C: Community Greenhouse Gas Emissions in 1997

Detailed Report

		Equiv CO2 (tons)	Equiv CO2 (%)	Energy (MMBtu)
RESIDENTIAL				
	Electricity	25,613	8.8	226,935
	Light Fuel Oil	31,435	10.9	380,273
	Natural Gas	5,773	2	93,446
	Propane	2	0	21
SUBTOTAL RESIDENTIAL		62,823	21.7	700,675
COMMERCIAL				
	Coal (UMass Plant)	69,600	24	641,277
	Electricity	56,597	19.5	501,454
	Light Fuel Oil	3,749	1.3	45,348
	Natural Gas	17,663	6.1	285,894
	Propane	0	0	4
SUBTOTAL COMMERCIAL		147,608	51	1,473,977
INDUSTRIAL				
	Electricity	413	0.1	3,659
	Light Fuel Oil	146	0.1	1,765
	Natural Gas	128	0	2,073
	Propane	0	0	2
SUBTOTAL INDUSTRIAL		687	0.2	7,499
TRANSPORTATION				
	Gasoline	62,288	21.5	721,603
	Diesel	6,072	2.1	69,445
	CNG	1	0	15
	LPG	763	0.3	10,211
SUBTOTAL TRANSPORTATION		69,124	23.9	801,274
WASTE				
	Paper Products	7,360	2.5	
	Food Waste	2,350	0.8	
	Plant Debris	-258	-0.1	
	Wood/Textiles	6	-0.1	
SUBTOTAL WASTE		9,297	3.2	
TOTAL COMMUNITY GREENHOUSE GAS EMISSIONS		289,539	100	2,983,424

APPENDIX D: Government Greenhouse Gas Emissions in 1997

Report by Subsector

	Equiv CO2 (tons)	Equiv CO2 (%)	Energy (MMBtu)	Cost (\$)
BUILDINGS				
City Hall/Administration				
Town Hall	2	0	30	123
<i>Subtotal</i>	2	0	30	123
Fire Services Buildings				
601 E Pleasant St Wtr Twrs	0	0	0	458
Central Fire Station	75	0.7	848	8,749
North Fire Station	31	0.3	283	22,306
Tower Rd Pelham	2	0	17	693
<i>Subtotal</i>	108	1	1,148	32,206
Library				
Jones Library	182	1.7	1,620	61,114
Munson Library	41	0.4	455	5,185
N. Amherst Library	10	0.1	110	1,652
<i>Subtotal</i>	232	2.2	2,184	67,951
Maintenance Facility				
Landfill compactor	0	0	4	488
Landfill Lunch Rm	1	0	7	182
Landfill/740 Belchertown Rd	131	1.2	1,587	8,966
Public Works/596 S Pleasant	169	1.6	1,965	16,528
<i>Subtotal</i>	301	2.8	3,564	26,164
Other				
HCAC	0	0	4	818
N Prospect St (parking)	0	0	0	429
Ruxton - 531 Pulpit Hill Rd	2	0	14	1,059
<i>Subtotal</i>	2	0	18	2,306
Police Services				
Police Station	146	1.4	1,296	47,577
<i>Subtotal</i>	146	1.4	1,296	47,577
Recreation Center				
Cherry Hill	14	0.1	196	3,827
Mill Ln./Groff Pk	1	0	8	449
Mill River pools	7	0.1	65	2,305
Triangle St Storage	0	0	2	464
Triangle St/War Mem. pool	5	0	42	1,804
<i>Subtotal</i>	28	0.3	313	8,849
Schools				
Crocker Farm Elementary	415	3.9	4,671	50,147
East Street Elementary	75	0.7	885	6,918
Fort River Elementary	680	6.4	7,586	80,445

Government Greenhouse Gas Emissions in 1997

Report by Subsector

	Equiv CO2 (tons)	Equiv CO2 (%)	Energy (MMBtu)	Cost (\$)
BUILDINGS (continued)				
Schools (continued)				
Middle School	1,585	14.8	17,654	213,889
Middle School Portables	16	0.2	145	5,643
N Amherst School	14	0.1	164	28,164
Senior High - Old	1,088	10.2	12,396	109,605
Senior High - Old Portables	2	0	20	1,043
Senior High Athletic Field	5	0	46	2,988
Senior High Portables	31	0.3	272	11,518
Senior High Scoreboard	1	0	6	865
South Amherst School	69	0.6	814	5,112
Wildwood Elementary	472	4.4	5,201	67,590
<i>Subtotal</i>	<i>4,453</i>	<i>41.6</i>	<i>49,863</i>	<i>583,927</i>
Senior Center				
Bangs	128	1.2	1,138	47,079
<i>Subtotal</i>	<i>128</i>	<i>1.2</i>	<i>1,138</i>	<i>47,079</i>

BUILDINGS SUBTOTAL	5,399	50.5	59,552	816,182
---------------------------	--------------	-------------	---------------	----------------

VEHICLE FLEET

Bangs Community Center	3	0	34	359
Building Maintenance	6	0.1	68	725
Cherry Hill Golf Course	41	0.4	473	5,212
Conservation Department	8	0.1	93	979
Council on Aging	7	0.1	80	797
Equipment Maintenance	316	2.9	3,622	31,515
Fire Department	232	2.2	2,763	30,497
Liesure Services	8	0.1	93	970
Parks Department	40	0.4	456	3,835
Police Department	377	3.5	4,399	47,505
Schools	413	3.9	4,757	51,635
Tree Department	35	0.3	404	3,418
Water Department	75	0.7	859	7,108

VEHICLE FLEET SUBTOTAL	1,550	14.5	18,008	137,709
-------------------------------	--------------	-------------	---------------	----------------

EMPLOYEE COMMUTE	1,827	17.1	21,293	
-------------------------	--------------	-------------	---------------	--

EMPLOYEE COMMUTE SUBTOTAL	1,827	17.1	21,293	
----------------------------------	--------------	-------------	---------------	--

Government Greenhouse Gas Emissions in 1997

Report by Subsector

	Equiv CO2 (tons)	Equiv CO2 (%)	Energy (MMBtu)	Cost (\$)
STREETLIGHTS				
All Streetlights	197	1.8	1,748	10,662
Amherst Regional Hig/Matt. St.	0	0	0	423
Traff Igts Amity	4	0	33	1,107
Traff Igts Fearing & N Pleasant	2	0	17	779
Traff Igts Governor	3	0	30	1,046
Traff Igts Main St	4	0	32	1,056
Traff Igts N Pleas&Kellog	3	0	22	885
Traff Igts N pleasant	2	0	21	1,284
Traff Igts S East&College	2	0	21	1,470
Traff Igts signal @ Triangle	4	0	33	1,023
Traff Igts Triangle & Main	3	0	25	834
Traff Igts West St	0	0	1	225
Traff Lts Rt 9 & 116	4	0	36	1,164
STREETLIGHTS SUBTOTAL	228	2.1	2,020	21,958

WATER / SEWAGE

115 Heatherstone Rd Alarm	0	0	0	18
33 Market Hill Rd	286	2.7	2,856	50,833
Alarm -86 Amherst Rd/Pelham	59	0.5	711	3,863
Amherst Rd Pelham Filter plant	109	1	965	18,526
Cherry Ln	1	0	10	621
End of Blackberry Ln	5	0	44	1,406
Henry St	5	0	43	1,568
Landfill Pump Station	2	0	16	821
Lawrence Swamp Pump	55	0.5	491	19,336
Logtown Rd Landfill Pump Sta.	0	0	1	373
Main St pumping	4	0	37	1,285
Middle St	0	0	3	475
Mullins Way, Hadley	620	5.8	5,500	151,060
Old Farm Rd Pumping Station	4	0	33	1,292
Pondview De Alarm Panel	0	0	0	229
Pumping Station - 1040 N Pleas	6	0.1	51	1,661
Riverglade Dr	2	0	15	730
S E Station # 2	2	0	14	725
S E Station #3	2	0	13	686
S E Station #4	1	0	10	637
S East St	28	0.3	319	4,735
S East Station # 1	3	0	24	1,082

Government Greenhouse Gas Emissions in 1997

Report by Subsector

	Equiv CO2 (tons)	Equiv CO2 (%)	Energy (MMBtu)	Cost (\$)
WATER / SEWAGE (continued)				
Stanley St	77	0.7	680	21,446
Station Rd	162	1.5	1,433	37,340
Sweetser Park	0	0	3	507
Warren Wright Rd, Belchertwn	201	1.9	1,782	42,137
Water Tank - Bay Rd	15	0.1	130	5,945
West St	42	0.4	372	14,033
Woodlot Rd	0	0	4	484
WATER / SEWAGE SUBTOTAL	1,690	15.8	15,560	383,854
TOTAL GOVERNMENT GREENHOUSE EMISSIONS	10,695	100	116,433	1,359,703